

HUMAN TRANSMEMBRANE PROTEINS

TECHNICAL FIELD

5 This invention relates to nucleic acid and amino acid sequences of human transmembrane proteins and to the use of these sequences in the diagnosis, treatment, and prevention of immune, reproductive, smooth muscle, neurological, gastrointestinal, developmental, and cell proliferative disorders.

BACKGROUND OF THE INVENTION

10 Eukaryotic organisms are distinct from prokaryotes in possessing many intracellular organelle and vesicle structures. Many of the metabolic reactions which distinguish eukaryotic biochemistry from prokaryotic biochemistry take place within these structures. In particular, many cellular functions require very stringent reaction
15 conditions, and the organelles and vesicles enable compartmentalization and isolation of reactions which might otherwise disrupt cytosolic metabolic processes. The organelles include mitochondria, smooth and rough endoplasmic reticula, sarcoplasmic reticulum, and the Golgi body. The vesicles include phagosomes, lysosomes, endosomes, peroxisomes, and secretory vesicles. Organelles and vesicles are bounded by single or
20 double membranes.

Biological membranes are highly selective permeable barriers made up of lipid bilayer sheets composed of phosphoglycerides, fatty acids, cholesterol, phospholipids, glycolipids, proteoglycans, and proteins. Membranes contain ion pumps, ion channels, and specific receptors for external stimuli which transmit biochemical signals across the
25 membranes. These membranes also contain second messenger proteins which interact with these pumps, channels, and receptors to amplify and regulate transmission of these signals.

Plasma Membrane Proteins

Plasma membrane proteins (MPs) are divided into two groups based upon methods
30 of protein extraction from the membrane. Extrinsic or peripheral membrane proteins can be released using extremes of ionic strength or pH, urea, or other disruptors of protein interactions. Intrinsic or integral membrane proteins are released only when the lipid

bilayer of the membrane is dissolved by detergent.

Transmembrane proteins (TM) are characterized by an extracellular, a transmembrane, and an intracellular domain. TM domains are typically comprised of 15 to 25 hydrophobic amino acids which are predicted to adopt an α -helical conformation.

- 5 TM proteins are classified as bitopic (Types I and II) proteins, which span the membrane once, and polytopic (Types III and IV) (Singer, S.J. (1990) *Annu. Rev. Cell Biol.* 6:247-96) proteins which contain multiple membrane-spanning segments. TM proteins that act as cell-surface receptor proteins involved in signal transduction include growth and differentiation factor receptors, and receptor-interacting proteins such as *Drosophila*
- 10 pecanex and frizzled proteins, LIV-1 protein, NF2 protein, and GNS1/SUR4 eukaryotic integral membrane proteins. TM proteins also act as transporters of ions or metabolites, such as gap junction channels (connexins), and ion channels, and as cell anchoring proteins, such as lectins, integrins, and fibronectins. TM proteins are found in vesicle organelle-forming molecules, such as calveolins; or cell recognition molecules, such as
- 15 cluster of differentiation (CD) antigens, glycoproteins, and mucins.

- Many membrane proteins (MPs) contain amino acid sequence motifs that serve to localize proteins to specific subcellular sites. Examples of these motifs include PDZ domains, KDEL, RGD, NGR, and GSL sequence motifs, von Willebrand factor A (vWFA) domains, and EGF-like domains. RGD, NGR, and GSL motif-containing
- 20 peptides have been used as drug delivery agents in targeted cancer treatment of tumor vasculature (Arap, W. et al. (1998) *Science*, 279:377-380). Membrane proteins may also contain amino acid sequence motifs that serve to interact with extracellular or intracellular molecules, such as carbohydrate recognition domains.

- Chemical modification of amino acid residue side chains alters the manner in
- 25 which MPs interact with other molecules, for example, phospholipid membranes. Examples of such chemical modifications to amino acid residue side chains are covalent bond formation with glycosaminoglycans, oligosaccharides, phospholipids, acetyl and palmitoyl moieties, ADP-ribose, phosphate, and sulphate groups.

- RNA-encoding membrane proteins may have alternative splice sites which give
- 30 rise to proteins encoded by the same gene but with different messenger RNA and amino acid sequences. Splice variant membrane proteins may interact with other ligand and protein isoforms.

G-Protein Coupled Receptors

G-protein coupled receptors (GPCR) are a superfamily of integral membrane proteins which transduce extracellular signals. GPCRs include receptors for biogenic amines, lipid mediators of inflammation, peptide hormones, and sensory signal mediators.

5 The structure of these highly-conserved receptors consists of seven hydrophobic transmembrane (serpentine) regions, cysteine disulfide bridges between the second and third extracellular loops, an extracellular N-terminus, and a cytoplasmic C-terminus. Three extracellular loops alternate with three intracellular loops to link the seven transmembrane regions. The most conserved parts of these proteins are the
10 transmembrane regions and the first two cytoplasmic loops. A conserved, acidic-Arg-aromatic residue triplet present in the second cytoplasmic loop may interact with G proteins. A GPCR consensus pattern is characteristic of most proteins belonging to this superfamily (ExPASy PROSITE document PS00237; and Watson, S. and S. Arkinstall (1994) The G-protein Linked Receptor Facts Book, Academic Press, San Diego, CA, pp 2-6). Mutations and changes in transcriptional activation of GPCR-encoding
15 genes have been associated with neurological disorders such as schizophrenia, Parkinson's disease, Alzheimer's disease, drug addiction, and feeding disorders.

Scavenger Receptors

Macrophage scavenger receptors with broad ligand specificity may participate in
20 the binding of low density lipoproteins (LDL) and foreign antigens. Scavenger receptors types I and II are trimeric membrane proteins with each subunit containing a small N-terminal intracellular domain, a transmembrane domain, a large extracellular domain, and a C-terminal cysteine-rich domain. The extracellular domain contains a short spacer domain, an α -helical coiled-coil domain, and a triple helical collagenous domain. These
25 receptors have been shown to bind a spectrum of ligands, including chemically modified lipoproteins and albumin, polyribonucleotides, polysaccharides, phospholipids, and asbestos (Matsumoto, A. et al. (1990) Proc. Natl. Acad. Sci. 87:9133-9137; and Elomaa, O. et al. (1995) Cell 80:603-609). The scavenger receptors are thought to play a key role in atherogenesis by mediating uptake of modified LDL in arterial walls, and in host
30 defense by binding bacterial endotoxins, bacteria, and protozoa.

Tetraspan family proteins

The transmembrane 4 superfamily (TM4SF) or tetraspan family is a multigene

family encoding type III integral membrane proteins (Wright, M.D. and Tomlinson, M.G. (1994) Immunol. Today 15:588). TM4SF is comprised of membrane proteins which traverse the cell membrane four times. Members of the TM4SF include platelet and endothelial cell membrane proteins, melanoma-associated antigens, leukocyte surface glycoproteins, colonal carcinoma antigens, tumor-associated antigens, and surface proteins of the schistosome parasites (Jankowski, S.A. (1994) Oncogene 9:1205-1211). Members of the TM4SF share about 25-30% amino acid sequence identity with one another.

A number of TM4SF members have been implicated in signal transduction, control of cell adhesion, regulation of cell growth and proliferation, including development and oncogenesis, and cell motility, including tumor cell metastasis. Expression of TM4SF proteins is associated with a variety of tumors and the level of expression may be altered when cells are growing or activated.

Tumor Antigens

Tumor antigens are surface molecules that are differentially expressed in tumor cells relative to normal cells. Tumor antigens distinguish tumor cells immunologically from normal cells and provide diagnostic and therapeutic targets for human cancers (Takagi, S. et al. (1995) Int. J. Cancer 61: 706-715; Liu, E. et al. (1992) Oncogene 7: 1027-1032).

Ion channels

Ion channels are found in the plasma membranes of virtually every cell in the body. For example, chloride channels mediate a variety of cellular functions including regulation of membrane potentials and absorption and secretion of ions across epithelial membranes. When present in intracellular membranes of the Golgi apparatus and endocytic vesicles, chloride channels also regulate organelle pH (see, e.g., Greger, R. (1988) Annu. Rev. Physiol. 50:111-122). Electrophysiological and pharmacological properties of chloride channels, including ion conductance, current-voltage relationships, and sensitivity to modulators, suggest that different chloride channels exist in muscles, neurons, fibroblasts, epithelial cells, and lymphocytes.

Many channels have sites for phosphorylation by one or more protein kinases including protein kinase A, protein kinase C, tyrosine kinase, and casein kinase II, all of which regulate ion channel activity in cells. Inappropriate phosphorylation of proteins in cells has been linked to changes in cell cycle progression and cell differentiation. Changes

in the cell cycle have been linked to induction of apoptosis or cancer. Changes in cell differentiation have been linked to diseases and disorders of the reproductive system, immune system, and skeletal muscle.

Proton pumps

- 5 Proton ATPases are a large class of membrane proteins that use the energy of ATP hydrolysis to generate an electrochemical proton gradient across a membrane. The resultant gradient may be used to transport other ions across the membrane (Na^+ , K^+ , or Cl^-) or to maintain organelle pH. Proton ATPases are further subdivided into the mitochondrial F-ATPases, the plasma membrane ATPases, and the vacuolar ATPases.
- 10 The vacuolar ATPases establish and maintain an acidic pH within various vesicles involved in the processes of endocytosis and exocytosis (Mellman, I. et al. (1986) *Ann. Rev. Biochem.* 55:663-700).

- Proton-coupled, 12 membrane-spanning domain transporters such as PEPT 1 and PEPT 2 are responsible for gastrointestinal absorption and for renal reabsorption of
- 15 peptides using an electrochemical H^+ gradient as the driving force. Another type of peptide transporter, the TAP transporter, is a heterodimer consisting of TAP 1 and TAP 2 and is associated with antigen processing. Peptide antigens are transported across the membrane of the endoplasmic reticulum by TAP so they can be expressed on the cell surface in association with MHC molecules. Each TAP protein consists of multiple
- 20 hydrophobic membrane spanning segments and a highly conserved ATP-binding cassette (Boll, M. et al. (1996) *Proc. Natl. Acad. Sci.* 93:284-289). Pathogenic microorganisms, such as herpes simplex virus, may encode inhibitors of TAP-mediated peptide transport in order to evade immune surveillance (Marusina, K. and Manaco, J.J. (1996) *Curr. Opin. Hematol.* 3:19-26).

25 ABC Transporters

- The ATP-binding cassette (ABC) transporters, also called the "traffic ATPases", comprise a superfamily of membrane proteins that mediate transport and channel functions in prokaryotes and eukaryotes (Higgins, C.F. (1992) *Annu. Rev. Cell Biol.* 8:67-113). ABC proteins share a similar overall structure and significant sequence homology. All
- 30 ABC proteins contain a conserved domain of approximately two hundred amino acid residues which includes one or more nucleotide binding domains. Mutations in ABC transporter genes are associated with various disorders, such as hyperbilirubinemia

II/Dubin-Johnson syndrome, recessive Stargardt's disease, X-linked adrenoleukodystrophy, multidrug resistance, celiac disease, and cystic fibrosis.

Membrane Proteins Associated with Intercellular Communication

Intercellular communication is essential for the development and survival of multicellular organisms. Cells communicate with one another through the secretion and uptake of protein signaling molecules. The uptake of proteins into the cell is achieved by endocytosis, in which the interaction of signaling molecules with the plasma membrane surface, often via binding to specific receptors, results in the formation of plasma membrane-derived vesicles that enclose and transport the molecules into the cytosol. The secretion of proteins from the cell is achieved by exocytosis, in which molecules inside of the cell are packaged into membrane-bound transport vesicles derived from the *trans*-Golgi network. These vesicles fuse with the plasma membrane and release their contents into the surrounding extracellular space. Endocytosis and exocytosis result in the removal and addition of plasma membrane components and the recycling of these components is essential to maintain the integrity, identity, and functionality of both the plasma membrane and internal membrane-bound compartments.

Lysosomes are the site of degradation of intracellular material during autophagy and of extracellular molecules following endocytosis. Lysosomal enzymes are packaged into vesicles which bud from the *trans*-Golgi network. These vesicles fuse with endosomes to form the mature lysosome in which hydrolytic digestion of endocytosed material occurs. Lysosomes can fuse with autophagosomes to form a unique compartment in which the degradation of organelles and other intracellular components occurs. Protein sorting by transport vesicles, such as the endosome, has important consequences for a variety of physiological processes including cell surface growth, the biogenesis of distinct intracellular organelles, endocytosis, and the controlled secretion of hormones and neurotransmitters (Rothman, J.E. and Wieland, F.T. (1996) *Science* 272:227-234). In particular, neurodegenerative disorders and other neuronal pathologies are associated with biochemical flaws during endosomal protein sorting or endosomal biogenesis (Mayer R.J. et al. (1996) *Adv. Exp. Med. Biol.* 389:261-269).

Peroxisomes are organelles independent from the secretory pathway. They are the site of many peroxide-generating oxidative reactions in the cell. Peroxisomes are unique among eukaryotic organelles in that their size, number, and enzyme content vary

depending upon organism, cell type, and metabolic needs. The majority of peroxisome-associated proteins are membrane-bound or are found proximal to the cytosolic or the luminal side of the peroxisome membrane (Waterham, H.R. and Cregg, J.M. (1997) *BioEssays* 19:57-66).

- 5 Genetic defects in peroxisome proteins which result in peroxisomal deficiencies have been linked to a number of human pathologies, including Zellweger syndrome, rhizomelic chondrodysplasia punctata, X-linked adrenoleukodystrophy, acyl-CoA oxidase deficiency, bifunctional enzyme deficiency, classical Refsum's disease, DHAP alkyl transferase deficiency, and acatalasemia (Moser, H.W. and Moser, A.B. (1996) *Ann. NY*
10 *Acad. Sci.* 804:427-441). In addition, Gartner, J. et al. (1991; *Pediatr. Res.* 29:141-146) found a 22 kDa integral membrane protein associated with lower density peroxisome-like subcellular fractions in patients with Zellweger syndrome.

- Normal embryonic development and control of germ cell maturation is modulated by a number of secretory proteins which interact with their respective membrane-bound
15 receptors. Cell fate during embryonic development is determined by members of the activin/TGF- β superfamily, cadherins, IGF-2, and other morphogens. In addition, proliferation, maturation, and redifferentiation of germ cell and reproductive tissues are regulated, for example, by IGF-2, inhibins, activins, and follistatins (Petraglia, F. (1997) *Placenta* 18:3-8; Mather, J.P. et al. (1997) *Proc. Soc. Exp. Biol. Med.* 215:209-222).

20 **Endoplasmic Reticulum Membrane Proteins**

- The normal functioning of the eukaryotic cell requires that all newly synthesized proteins be correctly folded, modified, and delivered to specific intra- and extracellular sites. Newly synthesized membrane and secretory proteins enter a cellular sorting and distribution network during or immediately after synthesis and are routed to specific
25 locations inside and outside of the cell. The initial compartment in this process is the endoplasmic reticulum (ER) where proteins undergo modifications such as glycosylation, disulfide bond formation, and assembly into oligomers. The modified proteins are then transported through a series of membrane-bound compartments which include the various cisternae of the Golgi complex, where further carbohydrate modifications occur.
- 30 Transport between compartments occurs by means of vesicles that bud and fuse in a manner specific to the type of protein being transported. Once within the secretory pathway, proteins do not have to cross a membrane to reach the cell surface.

Although the majority of proteins processed through the ER are transported out of the organelle, some are retained. The signal for retention in the ER in mammalian cells consists of the tetrapeptide sequence, KDEL, located at the carboxyl terminus of proteins (Munro, S. (1986) Cell 46:291-300). Proteins containing this sequence leave the ER but
5 are quickly retrieved from the early Golgi cisternae and returned to the ER, while proteins lacking this signal continue through the secretory pathway.

Disruptions in the cellular secretory pathway have been implicated in several human diseases. In familial hypercholesterolemia the low density lipoprotein receptors remain in the ER, rather than moving to the cell surface (Pathak, R.K. (1988) J. Cell Biol.
10 106:1831-1841). Altered transport and processing of the β -amyloid precursor protein (β APP) involves the putative vesicle transport protein presenilin, and may play a role in early-onset Alzheimer's disease (Levy-Lahad, E. et al. (1995) Science 269:973-977). Changes in ER-derived calcium homeostasis have been associated with diseases such as cardiomyopathy, cardiac hypertrophy, myotonic dystrophy, Brody disease, Smith-McCort
15 dysplasia, and diabetes mellitus.

Mitochondrial Membrane Proteins

The mitochondrial electron transport (or respiratory) chain is a series of three enzyme complexes in the mitochondrial membrane that is responsible for the transport of electrons from NADH to oxygen and the coupling of this oxidation to the synthesis of
20 ATP (oxidative phosphorylation). ATP then provides the primary source of energy for driving the many energy-requiring reactions of a cell.

Most of the protein components of the mitochondrial respiratory chain are the products of nuclear encoded genes that are imported into the mitochondria and the remainder are products of mitochondrial genes. Defects and altered expression of
25 enzymes in the respiratory chain are associated with a variety of disease conditions in man, including, for example, neurodegenerative diseases, myopathies, and cancer.

Lymphocyte and Leukocyte Membrane Proteins

The B-cell response to antigens, which is modulated through receptors, is an essential component of the normal immune system. Mature B cells recognize foreign
30 antigens through B cell receptors (BCR) which are membrane-bound, specific antibodies that bind foreign antigens. The antigen/receptor complex is internalized and the antigen is proteolytically processed. To generate an efficient response to complex antigens, the

BCR, BCR-associated proteins, and T cell response are all required. Proteolytic fragments of the antigen are complexed with major histocompatibility complex-II (MHCII) molecules on the surface of the B cells where the complex can be recognized by T cells.

In contrast, macrophages and other lymphoid cells present antigens in association with MHC I molecules to T cells. T cells recognize and are activated by the MHC I-antigen complex through interactions with the T cell receptor/CD3 complex, a T cell-surface multimeric protein located in the plasma membrane. T cells activated by antigen presentation secrete a variety of lymphokines that induce B cell maturation and T cell proliferation and activate macrophages, which kill target cells.

Leukocytes have a fundamental role in the inflammatory and immune response and include monocytes/macrophages, mast cells, polymorphonucleoleukocytes, natural killer cells, neutrophils, eosinophils, basophils, and myeloid precursors. Leukocyte membrane proteins include members of the CD antigens, N-CAM, I-CAM, human leukocyte antigen (HLA) class I and HLA class II gene products, immunoglobulins, immunoglobulin receptors, complement, complement receptors, interferons, interferon receptors, interleukin receptors, and chemokine receptors.

Abnormal lymphocyte and leukocyte activity has been associated with acute disorders, such as AIDS, immune hypersensitivity, leukemias, leukopenia, systemic lupus, granulomatous disease, and eosinophilia.

20 Apoptosis-Associated Membrane Proteins

A variety of ligands, receptors, enzymes, tumor suppressors, viral gene products, pharmacological agents, and inorganic ions have important positive or negative roles in regulating and implementing the apoptotic destruction of a cell. Although some specific components of the apoptotic pathway have been identified and characterized, many interactions between the proteins involved are undefined, leaving major aspects of the pathway unknown.

A requirement for calcium in apoptosis was previously suggested by studies showing the involvement of calcium levels in DNA cleavage and Fas-mediated cell death (Hewish, D.R. and L.A. Burgoyne (1973) *Biochem. Biophys. Res. Comm.* 52:504-510; Vignaux, F. et al. (1995) *J. Exp. Med.* 181:781-786; Oshimi, Y. and S. Miyazaki (1995) *J. Immunol.* 154:599-609). Other studies show that intracellular calcium concentrations increase when apoptosis is triggered in thymocytes by either T cell receptor cross-linking

or by glucocorticoids and cell death can be prevented by blocking this increase (McConkey, D.J. et al. (1989) J. Immunol. 143:1801-1806; McConkey, D.J. et al. (1989) Arch. Biochem. Biophys. 269:365-370). Therefore, membrane proteins such as calcium channels are important for the apoptotic response.

5 Tumorigenesis

Tumorigenesis is associated with the activation of oncogenes which are derived from normal cellular genes. These oncogenes encode oncoproteins which are capable of converting normal cells into malignant cells. Some oncoproteins are mutant isoforms of the normal protein and other oncoproteins are abnormally expressed with respect to
10 location or level of expression. The latter category of oncoprotein causes cancer by altering transcriptional control of cell proliferation. Five classes of oncoproteins are known to affect the cell cycle controls. These classes include growth factors, growth factor receptors, intracellular signal transducers, nuclear transcription factors, and cell-cycle control proteins. These proteins include those which are modified by glycosylation,
15 phosphorylation, glycosaminoglycan attachment, sulphation, and lipidation.

Modulation of factors which act in the coordination of the human cell division cycle may provide an important means to reduce tumorigenesis. An example of the metastasis-associated proteins is the lysosomal membrane glycoprotein P2B/LAMP-1 which is also expressed in normal tissues. (Heffernan, M. et al. (1989) Cancer Res.
20 49:6077-6084.) In addition, mammalian proteins homologous to the plant pathogenesis-related proteins have been identified in hyperplastic glioma. (Murphy, E.V. et al. (1995) Gene 159:131-135.)

The discovery of new human transmembrane proteins and the polynucleotides encoding them satisfies a need in the art by providing new compositions which are useful
25 in the diagnosis, prevention, and treatment of immune, reproductive, smooth muscle, neurological, gastrointestinal, developmental, and cell proliferative disorders.

SUMMARY OF THE INVENTION

The invention features substantially purified polypeptides, human transmembrane proteins, referred to collectively as "HTMPN" and individually as "HTMPN-1", "HTMPN-2", "HTMPN-3", "HTMPN-4", "HTMPN-5", "HTMPN-6", "HTMPN-7", "HTMPN-8", "HTMPN-9", "HTMPN-10", "HTMPN-11", "HTMPN-12", "HTMPN-13",
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"HTMPN-14", "HTMPN-15", "HTMPN-16", "HTMPN-17", "HTMPN-18", "HTMPN-19", "HTMPN-20", "HTMPN-21", "HTMPN-22", "HTMPN-23", "HTMPN-24",
 "HTMPN-25", "HTMPN-26", "HTMPN-27", "HTMPN-28", "HTMPN-29", "HTMPN-30", "HTMPN-31", "HTMPN-32", "HTMPN-33", "HTMPN-34", "HTMPN-35",
 5 "HTMPN-36", "HTMPN-37", "HTMPN-38", "HTMPN-39", "HTMPN-40", "HTMPN-41", "HTMPN-42", "HTMPN-43", "HTMPN-44", "HTMPN-45", "HTMPN-46",
 "HTMPN-47", "HTMPN-48", "HTMPN-49", "HTMPN-50", "HTMPN-51", "HTMPN-52", "HTMPN-53", "HTMPN-54", "HTMPN-55", "HTMPN-56", "HTMPN-57",
 "HTMPN-58", "HTMPN-59", "HTMPN-60", "HTMPN-61", "HTMPN-62", "HTMPN-63", "HTMPN-64", "HTMPN-65", "HTMPN-66", "HTMPN-67", "HTMPN-68",
 10 "HTMPN-69", "HTMPN-70", "HTMPN-71", "HTMPN-72", "HTMPN-73", "HTMPN-74", "HTMPN-75", "HTMPN-76", "HTMPN-77", "HTMPN-78", and "HTMPN-79". In
 one aspect, the invention provides a substantially purified polypeptide comprising an
 amino acid sequence selected from the group consisting of SEQ ID NO:1, SEQ ID NO:2,
 15 SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:5, SEQ ID NO:6, SEQ ID NO:7, SEQ ID
 NO:8, SEQ ID NO:9, SEQ ID NO:10, SEQ ID NO:11, SEQ ID NO:12, SEQ ID NO:13,
 SEQ ID NO:14, SEQ ID NO:15, SEQ ID NO:16, SEQ ID NO:17, SEQ ID NO:18, SEQ
 ID NO:19, SEQ ID NO:20, SEQ ID NO:21, SEQ ID NO:22, SEQ ID NO:23, SEQ ID
 NO:24, SEQ ID NO:25, SEQ ID NO:26, SEQ ID NO:27, SEQ ID NO:28, SEQ ID NO:29,
 20 SEQ ID NO:30, SEQ ID NO:31, SEQ ID NO:32, SEQ ID NO:33, SEQ ID NO:34, SEQ
 ID NO:35, SEQ ID NO:36, SEQ ID NO:37, SEQ ID NO:38, SEQ ID NO:39, SEQ ID
 NO:40, SEQ ID NO:41, SEQ ID NO:42, SEQ ID NO:43, SEQ ID NO:44, SEQ ID NO:45,
 SEQ ID NO:46, SEQ ID NO:47, SEQ ID NO:48, SEQ ID NO:49, SEQ ID NO:50, SEQ
 ID NO:51, SEQ ID NO:52, SEQ ID NO:53, SEQ ID NO:54, SEQ ID NO:55, SEQ ID
 25 NO:56, SEQ ID NO:57, SEQ ID NO:58, SEQ ID NO:59, SEQ ID NO:60, SEQ ID NO:61,
 SEQ ID NO:62, SEQ ID NO:63, SEQ ID NO:64, SEQ ID NO:65, SEQ ID NO:66, SEQ
 ID NO:67, SEQ ID NO:68, SEQ ID NO:69, SEQ ID NO:70, SEQ ID NO:71, SEQ ID
 NO:72, SEQ ID NO:73, SEQ ID NO:74, SEQ ID NO:75, SEQ ID NO:76, SEQ ID NO:77,
 SEQ ID NO:78, and SEQ ID NO:79 (SEQ ID NO:1-79), and fragments thereof.

30 The invention further provides a substantially purified variant having at least 90%
 amino acid identity to at least one of the amino acid sequences selected from the group
 consisting of SEQ ID NO:1-79, and fragments thereof. The invention also provides an

isolated and purified polynucleotide encoding the polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof. The invention also includes an isolated and purified polynucleotide variant having at least 90% polynucleotide sequence identity to the polynucleotide encoding the polypeptide

5 comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof.

Additionally, the invention provides an isolated and purified polynucleotide which hybridizes under stringent conditions to the polynucleotide encoding the polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-

10 79, and fragments thereof. The invention also provides an isolated and purified polynucleotide having a sequence which is complementary to the polynucleotide encoding the polypeptide comprising the amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof.

The invention also provides an isolated and purified polynucleotide comprising a

15 polynucleotide sequence selected from the group consisting of SEQ ID NO:80, SEQ ID NO:81, SEQ ID NO:82, SEQ ID NO:83, SEQ ID NO:84, SEQ ID NO:85, SEQ ID NO:86, SEQ ID NO:87, SEQ ID NO:88, SEQ ID NO:89, SEQ ID NO:90, SEQ ID NO:91, SEQ ID NO:92, SEQ ID NO:93, SEQ ID NO:94, SEQ ID NO:95, SEQ ID NO:96, SEQ ID NO:97, SEQ ID NO:98, SEQ ID NO:99, SEQ ID NO:100, SEQ ID NO:101, SEQ ID

20 NO:102, SEQ ID NO:103, SEQ ID NO:104, SEQ ID NO:105, SEQ ID NO:106, SEQ ID NO:107, SEQ ID NO:108, SEQ ID NO:109, SEQ ID NO:110, SEQ ID NO:111, SEQ ID NO:112, SEQ ID NO:113, SEQ ID NO:114, SEQ ID NO:115, SEQ ID NO:116, SEQ ID NO:117, SEQ ID NO:118, SEQ ID NO:119, SEQ ID NO:120, SEQ ID NO:121, SEQ ID NO:122, SEQ ID NO:123, SEQ ID NO:124, SEQ ID NO:125, SEQ ID NO:126, SEQ ID

25 NO:127, SEQ ID NO:128, SEQ ID NO:129, SEQ ID NO:130, SEQ ID NO:131, SEQ ID NO:132, SEQ ID NO:133, SEQ ID NO:134, SEQ ID NO:135, SEQ ID NO:136, SEQ ID NO:137, SEQ ID NO:138, SEQ ID NO:139, SEQ ID NO:140, SEQ ID NO:141, SEQ ID NO:142, SEQ ID NO:143, SEQ ID NO:144, SEQ ID NO:145, SEQ ID NO:146, SEQ ID NO:147, SEQ ID NO:148, SEQ ID NO:149, SEQ ID NO:150, SEQ ID NO:151, SEQ ID

30 NO:152, SEQ ID NO:153, SEQ ID NO:154, SEQ ID NO:155, SEQ ID NO:156, SEQ ID NO:157, and SEQ ID NO:158 (SEQ ID NO:80-158), and fragments thereof. The invention further provides an isolated and purified polynucleotide variant having at least

90% polynucleotide sequence identity to the polynucleotide sequence selected from the group consisting of SEQ ID NO:80-158, and fragments thereof. The invention also provides an isolated and purified polynucleotide having a sequence which is complementary to the polynucleotide comprising a polynucleotide sequence selected from the group consisting of SEQ ID NO:80-158, and fragments thereof.

The invention also provides a method for detecting a polynucleotide in a sample containing nucleic acids, the method comprising the steps of (a) hybridizing the complement of the polynucleotide sequence to at least one of the polynucleotides of the sample, thereby forming a hybridization complex; and (b) detecting the hybridization complex, wherein the presence of the hybridization complex correlates with the presence of a polynucleotide in the sample. In one aspect, the method further comprises amplifying the polynucleotide prior to hybridization.

The invention further provides an expression vector containing at least a fragment of the polynucleotide encoding the polypeptide comprising an amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof. In another aspect, the expression vector is contained within a host cell.

The invention also provides a method for producing a polypeptide, the method comprising the steps of: (a) culturing the host cell containing an expression vector containing at least a fragment of a polynucleotide under conditions suitable for the expression of the polypeptide; and (b) recovering the polypeptide from the host cell culture.

The invention also provides a pharmaceutical composition comprising a substantially purified polypeptide having the amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof, in conjunction with a suitable pharmaceutical carrier.

The invention further includes a purified antibody which binds to a polypeptide selected from the group consisting of SEQ ID NO:1-79, and fragments thereof. The invention also provides a purified agonist and a purified antagonist to the polypeptide.

The invention also provides a method for treating or preventing a disorder associated with decreased expression or activity of HTMPN, the method comprising administering to a subject in need of such treatment an effective amount of a pharmaceutical composition comprising a substantially purified polypeptide having the

amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof, in conjunction with a suitable pharmaceutical carrier.

The invention also provides a method for treating or preventing a disorder associated with increased expression or activity of HTMPN, the method comprising
5 administering to a subject in need of such treatment an effective amount of an antagonist of a polypeptide having an amino acid sequence selected from the group consisting of SEQ ID NO:1-79, and fragments thereof.

BRIEF DESCRIPTION OF THE TABLES

10 Table 1 shows nucleotide and polypeptide sequence identification numbers (SEQ ID NOs), clone identification numbers (clone ID), cDNA libraries, and cDNA fragments used to assemble full-length sequences encoding HTMPN.

Table 2 shows features of each polypeptide sequence including predicted transmembrane sequences, potential motifs, homologous sequences, and methods and
15 algorithms used for identification of HTMPN.

Table 3 shows the tissue-specific expression patterns of each nucleic acid sequence as determined by northern analysis, diseases, disorders, or conditions associated with these tissues, and the vector into which each cDNA was cloned.

Table 4 describes the tissues used to construct the cDNA libraries from which
20 Incyte cDNA clones encoding HTMPN were isolated.

Table 5 shows the programs, their descriptions, references, and threshold parameters used to analyze HTMPN.

DESCRIPTION OF THE INVENTION

25 Before the present proteins, nucleotide sequences, and methods are described, it is understood that this invention is not limited to the particular machines, materials and methods described, as these may vary. It is also to be understood that the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to limit the scope of the present invention which will be limited only by the
30 appended claims.

It must be noted that as used herein and in the appended claims, the singular forms "a," "an," and "the" include plural reference unless the context clearly dictates otherwise.

Thus, for example, a reference to "a host cell" includes a plurality of such host cells, and a reference to "an antibody" is a reference to one or more antibodies and equivalents thereof known to those skilled in the art, and so forth.

Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs. Although any machines, materials, and methods similar or equivalent to those described herein can be used to practice or test the present invention, the preferred machines, materials and methods are now described. All publications mentioned herein are cited for the purpose of describing and disclosing the cell lines, protocols, reagents and vectors which are reported in the publications and which might be used in connection with the invention. Nothing herein is to be construed as an admission that the invention is not entitled to antedate such disclosure by virtue of prior invention.

DEFINITIONS

"HTMPN" refers to the amino acid sequences of substantially purified HTMPN obtained from any species, particularly a mammalian species, including bovine, ovine, porcine, murine, equine, and preferably the human species, from any source, whether natural, synthetic, semi-synthetic, or recombinant.

The term "agonist" refers to a molecule which, when bound to HTMPN, increases or prolongs the duration of the effect of HTMPN. Agonists may include proteins, nucleic acids, carbohydrates, or any other molecules which bind to and modulate the effect of HTMPN.

An "allelic variant" is an alternative form of the gene encoding HTMPN. Allelic variants may result from at least one mutation in the nucleic acid sequence and may result in altered mRNAs or in polypeptides whose structure or function may or may not be altered. Any given natural or recombinant gene may have none, one, or many allelic forms. Common mutational changes which give rise to allelic variants are generally ascribed to natural deletions, additions, or substitutions of nucleotides. Each of these types of changes may occur alone, or in combination with the others, one or more times in a given sequence.

"Altered" nucleic acid sequences encoding HTMPN include those sequences with deletions, insertions, or substitutions of different nucleotides, resulting in a polynucleotide the same as HTMPN or a polypeptide with at least one functional characteristic of

HTMPN. Included within this definition are polymorphisms which may or may not be readily detectable using a particular oligonucleotide probe of the polynucleotide encoding HTMPN, and improper or unexpected hybridization to allelic variants, with a locus other than the normal chromosomal locus for the polynucleotide sequence encoding HTMPN.

- 5 The encoded protein may also be "altered," and may contain deletions, insertions, or substitutions of amino acid residues which produce a silent change and result in a functionally equivalent HTMPN. Deliberate amino acid substitutions may be made on the basis of similarity in polarity, charge, solubility, hydrophobicity, hydrophilicity, and/or the amphipathic nature of the residues, as long as the biological or immunological activity of
- 10 HTMPN is retained. For example, negatively charged amino acids may include aspartic acid and glutamic acid, positively charged amino acids may include lysine and arginine, and amino acids with uncharged polar head groups having similar hydrophilicity values may include leucine, isoleucine, and valine; glycine and alanine; asparagine and glutamine; serine and threonine; and phenylalanine and tyrosine.

- 15 The terms "amino acid" or "amino acid sequence" refer to an oligopeptide, peptide, polypeptide, or protein sequence, or a fragment of any of these, and to naturally occurring or synthetic molecules. In this context, "fragments," "immunogenic fragments," or "antigenic fragments" refer to fragments of HTMPN which are preferably at least 5 to about 15 amino acids in length, most preferably at least 14 amino acids, and which retain
- 20 some biological activity or immunological activity of HTMPN. Where "amino acid sequence" is recited to refer to an amino acid sequence of a naturally occurring protein molecule, "amino acid sequence" and like terms are not meant to limit the amino acid sequence to the complete native amino acid sequence associated with the recited protein molecule.

- 25 "Amplification" relates to the production of additional copies of a nucleic acid sequence. Amplification is generally carried out using polymerase chain reaction (PCR) technologies well known in the art.

- The term "antagonist" refers to a molecule which, when bound to HTMPN, decreases the amount or the duration of the effect of the biological or immunological
- 30 activity of HTMPN. Antagonists may include proteins, nucleic acids, carbohydrates, antibodies, or any other molecules which decrease the effect of HTMPN.

The term "antibody" refers to intact molecules as well as to fragments thereof, such

as Fab, F(ab')₂, and Fv fragments, which are capable of binding the epitopic determinant. Antibodies that bind HTMPN polypeptides can be prepared using intact polypeptides or using fragments containing small peptides of interest as the immunizing antigen. The polypeptide or oligopeptide used to immunize an animal (e.g., a mouse, a rat, or a rabbit) can be derived from the translation of RNA, or synthesized chemically, and can be conjugated to a carrier protein if desired. Commonly used carriers that are chemically coupled to peptides include bovine serum albumin, thyroglobulin, and keyhole limpet hemocyanin (KLH). The coupled peptide is then used to immunize the animal.

The term "antigenic determinant" refers to that fragment of a molecule (i.e., an epitope) that makes contact with a particular antibody. When a protein or a fragment of a protein is used to immunize a host animal, numerous regions of the protein may induce the production of antibodies which bind specifically to antigenic determinants (given regions or three-dimensional structures on the protein). An antigenic determinant may compete with the intact antigen (i.e., the immunogen used to elicit the immune response) for binding to an antibody.

The term "antisense" refers to any composition containing a nucleic acid sequence which is complementary to the "sense" strand of a specific nucleic acid sequence. Antisense molecules may be produced by any method including synthesis or transcription. Once introduced into a cell, the complementary nucleotides combine with natural sequences produced by the cell to form duplexes and to block either transcription or translation. The designation "negative" can refer to the antisense strand, and the designation "positive" can refer to the sense strand.

The term "biologically active," refers to a protein having structural, regulatory, or biochemical functions of a naturally occurring molecule. Likewise, "immunologically active" refers to the capability of the natural, recombinant, or synthetic HTMPN, or of any oligopeptide thereof, to induce a specific immune response in appropriate animals or cells and to bind with specific antibodies.

The terms "complementary" or "complementarity" refer to the natural binding of polynucleotides by base pairing. For example, the sequence "5' A-G-T 3'" bonds to the complementary sequence "3' T-C-A 5'." Complementarity between two single-stranded molecules may be "partial," such that only some of the nucleic acids bind, or it may be "complete," such that total complementarity exists between the single stranded molecules.

The degree of complementarity between nucleic acid strands has significant effects on the efficiency and strength of the hybridization between the nucleic acid strands. This is of particular importance in amplification reactions, which depend upon binding between nucleic acids strands, and in the design and use of peptide nucleic acid (PNA) molecules.

5 A "composition comprising a given polynucleotide sequence" or a "composition comprising a given amino acid sequence" refer broadly to any composition containing the given polynucleotide or amino acid sequence. The composition may comprise a dry formulation or an aqueous solution. Compositions comprising polynucleotide sequences encoding HTMPN or fragments of HTMPN may be employed as hybridization probes.

10 The probes may be stored in freeze-dried form and may be associated with a stabilizing agent such as a carbohydrate. In hybridizations, the probe may be deployed in an aqueous solution containing salts (e.g., NaCl), detergents (e.g., sodium dodecyl sulfate; SDS), and other components (e.g., Denhardt's solution, dry milk, salmon sperm DNA, etc.).

"Consensus sequence" refers to a nucleic acid sequence which has been
15 resequenced to resolve uncalled bases, extended using XL-PCR kit (Perkin-Elmer, Norwalk CT) in the 5' and/or the 3' direction, and resequenced, or which has been assembled from the overlapping sequences of more than one Incyte Clone using a computer program for fragment assembly, such as the GELVIEW Fragment Assembly system (GCG, Madison WI). Some sequences have been both extended and assembled to
20 produce the consensus sequence.

The term "correlates with expression of a polynucleotide" indicates that the detection of the presence of nucleic acids, the same or related to a nucleic acid sequence encoding HTMPN, by northern analysis is indicative of the presence of nucleic acids encoding HTMPN in a sample, and thereby correlates with expression of the transcript
25 from the polynucleotide encoding HTMPN.

A "deletion" refers to a change in the amino acid or nucleotide sequence that results in the absence of one or more amino acid residues or nucleotides.

The term "derivative" refers to the chemical modification of a polypeptide sequence, or a polynucleotide sequence. Chemical modifications of a polynucleotide
30 sequence can include, for example, replacement of hydrogen by an alkyl, acyl, or amino group. A derivative polynucleotide encodes a polypeptide which retains at least one biological or immunological function of the natural molecule. A derivative polypeptide is

one modified by glycosylation, pegylation, or any similar process that retains at least one biological or immunological function of the polypeptide from which it was derived.

The term "similarity" refers to a degree of complementarity. There may be partial similarity or complete similarity. The word "identity" may substitute for the word "similarity." A partially complementary sequence that at least partially inhibits an identical sequence from hybridizing to a target nucleic acid is referred to as "substantially similar." The inhibition of hybridization of the completely complementary sequence to the target sequence may be examined using a hybridization assay (Southern or northern blot, solution hybridization, and the like) under conditions of reduced stringency. A substantially similar sequence or hybridization probe will compete for and inhibit the binding of a completely similar (identical) sequence to the target sequence under conditions of reduced stringency. This is not to say that conditions of reduced stringency are such that non-specific binding is permitted, as reduced stringency conditions require that the binding of two sequences to one another be a specific (i.e., a selective) interaction. The absence of non-specific binding may be tested by the use of a second target sequence which lacks even a partial degree of complementarity (e.g., less than about 30% similarity or identity). In the absence of non-specific binding, the substantially similar sequence or probe will not hybridize to the second non-complementary target sequence.

The phrases "percent identity" or "% identity" refer to the percentage of sequence similarity found in a comparison of two or more amino acid or nucleic acid sequences. Percent identity can be determined electronically, e.g., by using the MEGALIGN program (DNASTAR, Madison WI) which creates alignments between two or more sequences according to methods selected by the user, e.g., the clustal method. (See, e.g., Higgins, D.G. and P.M. Sharp (1988) Gene 73:237-244.) The clustal algorithm groups sequences into clusters by examining the distances between all pairs. The clusters are aligned pairwise and then in groups. The percentage similarity between two amino acid sequences, e.g., sequence A and sequence B, is calculated by dividing the length of sequence A, minus the number of gap residues in sequence A, minus the number of gap residues in sequence B, into the sum of the residue matches between sequence A and sequence B, times one hundred. Gaps of low or of no similarity between the two amino acid sequences are not included in determining percentage similarity. Percent identity between nucleic acid sequences can also be counted or calculated by other methods known

in the art, e.g., the Jotun Hein method. (See, e.g., Hein, J. (1990) *Methods Enzymol.* 183:626-645.) Identity between sequences can also be determined by other methods known in the art, e.g., by varying hybridization conditions.

“Human artificial chromosomes” (HACs) are linear microchromosomes which
5 may contain DNA sequences of about 6 kb to 10 Mb in size, and which contain all of the elements required for stable mitotic chromosome segregation and maintenance.

The term “humanized antibody” refers to antibody molecules in which the amino acid sequence in the non-antigen binding regions has been altered so that the antibody more closely resembles a human antibody, and still retains its original binding ability.

10 “Hybridization” refers to any process by which a strand of nucleic acid binds with a complementary strand through base pairing.

The term “hybridization complex” refers to a complex formed between two nucleic acid sequences by virtue of the formation of hydrogen bonds between complementary bases. A hybridization complex may be formed in solution (e.g., C_0t or R_0t analysis) or
15 formed between one nucleic acid sequence present in solution and another nucleic acid sequence immobilized on a solid support (e.g., paper, membranes, filters, chips, pins or glass slides, or any other appropriate substrate to which cells or their nucleic acids have been fixed).

The words “insertion” or “addition” refer to changes in an amino acid or nucleotide
20 sequence resulting in the addition of one or more amino acid residues or nucleotides, respectively, to the sequence found in the naturally occurring molecule.

“Immune response” can refer to conditions associated with inflammation, trauma, immune disorders, or infectious or genetic disease, etc. These conditions can be characterized by expression of various factors, e.g., cytokines, chemokines, and other
25 signaling molecules, which may affect cellular and systemic defense systems.

The term “microarray” refers to an arrangement of distinct polynucleotides on a substrate.

The terms “element” or “array element” in a microarray context, refer to hybridizable polynucleotides arranged on the surface of a substrate.

30 The term “modulate” refers to a change in the activity of HTMPN. For example, modulation may cause an increase or a decrease in protein activity, binding characteristics, or any other biological, functional, or immunological properties of HTMPN.

The phrases "nucleic acid" or "nucleic acid sequence" refer to a nucleotide, oligonucleotide, polynucleotide, or any fragment thereof. These phrases also refer to DNA or RNA of genomic or synthetic origin which may be single-stranded or double-stranded and may represent the sense or the antisense strand, to peptide nucleic acid (PNA), or to
5 any DNA-like or RNA-like material. In this context, "fragments" refers to those nucleic acid sequences which, when translated, would produce polypeptides retaining some functional characteristic, e.g., antigenicity, or structural domain characteristic, e.g., ATP-binding site, of the full-length polypeptide.

The terms "operably associated" or "operably linked" refer to functionally related
10 nucleic acid sequences. A promoter is operably associated or operably linked with a coding sequence if the promoter controls the translation of the encoded polypeptide. While operably associated or operably linked nucleic acid sequences can be contiguous and in the same reading frame, certain genetic elements, e.g., repressor genes, are not contiguously linked to the sequence encoding the polypeptide but still bind to operator
15 sequences that control expression of the polypeptide.

The term "oligonucleotide" refers to a nucleic acid sequence of at least about 6 nucleotides to 60 nucleotides, preferably about 15 to 30 nucleotides, and most preferably about 20 to 25 nucleotides, which can be used in PCR amplification or in a hybridization assay or microarray. "Oligonucleotide" is substantially equivalent to the terms
20 "amplimer," "primer," "oligomer," and "probe," as these terms are commonly defined in the art.

"Peptide nucleic acid" (PNA) refers to an antisense molecule or anti-gene agent which comprises an oligonucleotide of at least about 5 nucleotides in length linked to a peptide backbone of amino acid residues ending in lysine. The terminal lysine confers
25 solubility to the composition. PNAs preferentially bind complementary single stranded DNA or RNA and stop transcript elongation, and may be pegylated to extend their lifespan in the cell.

The term "sample" is used in its broadest sense. A sample suspected of containing nucleic acids encoding HTMPN, or fragments thereof, or HTMPN itself, may comprise a
30 bodily fluid; an extract from a cell, chromosome, organelle, or membrane isolated from a cell; a cell; genomic DNA, RNA, or cDNA, in solution or bound to a substrate; a tissue; a tissue print; etc.

The terms "specific binding" or "specifically binding" refer to that interaction between a protein or peptide and an agonist, an antibody, or an antagonist. The interaction is dependent upon the presence of a particular structure of the protein, e.g., the antigenic determinant or epitope, recognized by the binding molecule. For example, if an antibody is specific for epitope "A," the presence of a polypeptide containing the epitope A, or the presence of free unlabeled A, in a reaction containing free labeled A and the antibody will reduce the amount of labeled A that binds to the antibody.

The term "stringent conditions" refers to conditions which permit hybridization between polynucleotides and the claimed polynucleotides. Stringent conditions can be defined by salt concentration, the concentration of organic solvent, e.g., formamide, temperature, and other conditions well known in the art. In particular, stringency can be increased by reducing the concentration of salt, increasing the concentration of formamide, or raising the hybridization temperature.

The term "substantially purified" refers to nucleic acid or amino acid sequences that are removed from their natural environment and are isolated or separated, and are at least about 60% free, preferably about 75% free, and most preferably about 90% free from other components with which they are naturally associated.

A "substitution" refers to the replacement of one or more amino acids or nucleotides by different amino acids or nucleotides, respectively.

"Substrate" refers to any suitable rigid or semi-rigid support including membranes, filters, chips, slides, wafers, fibers, magnetic or nonmagnetic beads, gels, tubing, plates, polymers, microparticles and capillaries. The substrate can have a variety of surface forms, such as wells, trenches, pins, channels and pores, to which polynucleotides or polypeptides are bound.

"Transformation" describes a process by which exogenous DNA enters and changes a recipient cell. Transformation may occur under natural or artificial conditions according to various methods well known in the art, and may rely on any known method for the insertion of foreign nucleic acid sequences into a prokaryotic or eukaryotic host cell. The method for transformation is selected based on the type of host cell being transformed and may include, but is not limited to, viral infection, electroporation, heat shock, lipofection, and particle bombardment. The term "transformed" cells includes stably transformed cells in which the inserted DNA is capable of replication either as an

autonomously replicating plasmid or as part of the host chromosome, as well as transiently transformed cells which express the inserted DNA or RNA for limited periods of time.

A "variant" of HTMPN polypeptides refers to an amino acid sequence that is altered by one or more amino acid residues. The variant may have "conservative" changes, wherein a substituted amino acid has similar structural or chemical properties (e.g., replacement of leucine with isoleucine). More rarely, a variant may have "nonconservative" changes (e.g., replacement of glycine with tryptophan). Analogous minor variations may also include amino acid deletions or insertions, or both. Guidance in determining which amino acid residues may be substituted, inserted, or deleted without abolishing biological or immunological activity may be found using computer programs well known in the art, for example, LASERGENE software (DNASTAR).

The term "variant," when used in the context of a polynucleotide sequence, may encompass a polynucleotide sequence related to HTMPN. This definition may also include, for example, "allelic" (as defined above), "splice," "species," or "polymorphic" variants. A splice variant may have significant identity to a reference molecule, but will generally have a greater or lesser number of polynucleotides due to alternate splicing of exons during mRNA processing. The corresponding polypeptide may possess additional functional domains or an absence of domains. Species variants are polynucleotide sequences that vary from one species to another. The resulting polypeptides generally will have significant amino acid identity relative to each other. A polymorphic variant is a variation in the polynucleotide sequence of a particular gene between individuals of a given species. Polymorphic variants also may encompass "single nucleotide polymorphisms" (SNPs) in which the polynucleotide sequence varies by one base. The presence of SNPs may be indicative of, for example, a certain population, a disease state, or a propensity for a disease state.

THE INVENTION

The invention is based on the discovery of new human transmembrane proteins (HTMPN), the polynucleotides encoding HTMPN, and the use of these compositions for the diagnosis, treatment, or prevention of immune, reproductive, smooth muscle, neurological, gastrointestinal, developmental, and cell proliferative disorders.

Table 1 lists the Incyte Clones used to derive full length nucleotide sequences encoding HTMPN. Columns 1 and 2 show the sequence identification numbers (SEQ ID

NOs) of the amino acid and nucleic acid sequences, respectively. Column 3 shows the Clone ID of the Incyte Clone in which nucleic acids encoding each HTMPN were identified, and column 4, the cDNA libraries from which these clones were isolated.

Column 5 shows Incyte clones, their corresponding cDNA libraries, and shotgun

- 5 sequences. The clones and shotgun sequences are part of the consensus nucleotide sequence of each HTMPN and are useful as fragments in hybridization technologies.

The columns of Table 2 show various properties of the polypeptides of the invention: column 1 references the SEQ ID NO; column 2 shows the number of amino acid residues in each polypeptide; column 3, potential phosphorylation sites; column 4, 10 potential glycosylation sites; column 5, the amino acid residues comprising signature sequences and motifs; column 6, the identity of each protein; and column 7, analytical methods used to identify each protein through sequence homology and protein motifs. Hidden Markov Model analysis indicates the presence of one or more potential transmembrane motifs in each of SEQ ID NO:63, SEQ ID NO:64, SEQ ID NO: 66, SEQ 15 ID NO:67, SEQ ID NO:68, SEQ ID NO:69, SEQ ID NO:70, SEQ ID NO:71, SEQ ID NO:72, SEQ ID NO:73, SEQ ID NO:74, SEQ ID NO: 75, SEQ ID NO:76, SEQ ID NO:77, and SEQ ID NO: 79; as well as the presence of one or more potential signal peptide motifs in each of SEQ ID NO:63, SEQ ID NO:64, SEQ ID NO:66, SEQ ID NO:67, SEQ ID NO:71, SEQ ID NO:72, SEQ ID NO:75, SEQ ID NO:77, and SEQ ID 20 NO:79.

Motifs analysis indicates the presence of a potential ATP/GTP binding site in SEQ ID NO:68, a potential calcium-binding site also in SEQ ID NO:68, a potential leucine zipper gene regulatory motif in each of SEQ ID NO:68 and SEQ ID NO:73; and a potential microbody (single-membraned organelle) targeting signal site in SEQ ID NO:78.

- 25 BLOCKS analysis indicates the presence of two potential PMP-22 integral membrane glycoprotein motifs and a trehalase motif, all in SEQ ID NO:77, as well as a potential protein-splicing motif in SEQ ID NO:66. PRINTS analysis indicates the presence of a potential G-protein coupled receptor motif in SEQ ID NO:79.

The columns of Table 3 show the tissue-specificity and diseases, disorders, or 30 conditions associated with nucleotide sequences encoding HTMPN. The first column of Table 3 lists the nucleotide sequence identifiers. The second column lists tissue categories which express HTMPN as a fraction of total tissue categories expressing HTMPN. The

third column lists the diseases, disorders, or conditions associated with those tissues expressing HTMPN. The fourth column lists the vectors used to subclone the cDNA library. Of particular note is the expression of HTMPN in tissue involved in inflammation and the immune response and with cell proliferative conditions including cancer, and in
5 reproductive, gastrointestinal, fetal, smooth muscle, cardiovascular, urologic, endocrine, developmental, and nervous tissue.

The following fragments of the nucleotide sequences encoding HTMPN are useful in hybridization or amplification technologies to identify SEQ ID NO:121-158 and to distinguish between SEQ ID NO:121-158 and related polynucleotide sequences. The
10 useful fragments are the fragment of SEQ ID NO:121 from about nucleotide 151 to about nucleotide 189; the fragment of SEQ ID NO:122 from about nucleotide 280 to about nucleotide 318; the fragment of SEQ ID NO:123 from about nucleotide 505 to about nucleotide 558; the fragments of SEQ ID NO:124 from about nucleotide 1 to about nucleotide 21 and from about nucleotide 694 to about nucleotide 720; the fragment of SEQ
15 ID NO:125 from about nucleotide 331 to about nucleotide 378; the fragment of SEQ ID NO:126 from about nucleotide 1012 to about nucleotide 1047; the fragment of SEQ ID NO:127 from about nucleotide 1070 to about nucleotide 1106; the fragment of SEQ ID NO:128 from about nucleotide 133 to about nucleotide 186; the fragment of SEQ ID NO:129 from about nucleotide 432 to about nucleotide 482; the fragments of SEQ ID
20 NO:130 from about nucleotide 1745 to about nucleotide 1795 and from about nucleotide 1910 to about nucleotide 1979; the fragment of SEQ ID NO:131 from about nucleotide 322 to about nucleotide 375; the fragment of SEQ ID NO:132 from about nucleotide 147 to about nucleotide 203; the fragment of SEQ ID NO:133 from about nucleotide 557 to about nucleotide 613; the fragment of SEQ ID NO:134 from about nucleotide 509 to about
25 nucleotide 595; the fragment of SEQ ID NO:135 from about nucleotide 808 to about nucleotide 848; the fragment of SEQ ID NO:136 from about nucleotide 216 to about nucleotide 260; the fragment of SEQ ID NO:137 from about nucleotide 132 to about nucleotide 188; the fragment of SEQ ID NO:138 from about nucleotide 231 to about nucleotide 278; the fragment of SEQ ID NO:139 from about nucleotide 303 to about
30 nucleotide 350; the fragment of SEQ ID NO:140 from about nucleotide 507 to about nucleotide 550; the fragment of SEQ ID NO:141 from about nucleotide 433 to about nucleotide 477; the fragment of SEQ ID NO:142 from about nucleotide 266 to about

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T09T40"06500260

nucleotide 314; the fragment of SEQ ID:143 from about nucleotide 3 to about nucleotide 48; the fragment of SEQ ID NO:144 from about nucleotide 76 to about nucleotide 122; the fragment of SEQ ID NO:145 from about nucleotide 93 to about nucleotide 139; the fragment of SEQ ID NO:146 from about nucleotide 241 to about nucleotide 286; the
5 fragment of SEQ ID NO:147 from about nucleotide 43 to about nucleotide 89; the fragment of SEQ ID NO:148 from about nucleotide 219 to about nucleotide 265; the fragment of SEQ ID NO:149 from about nucleotide 619 to about nucleotide 663; the fragment of SEQ ID NO:150 from about nucleotide 25 to about nucleotide 69; the fragment of SEQ ID NO:151 from about nucleotide 175 to about nucleotide 221; the
10 fragment of SEQ ID NO:152 from about nucleotide 94 to about nucleotide 138; the fragment of SEQ ID NO:153 from about nucleotide 46 to about nucleotide 90; the fragment of SEQ ID NO:154 from about nucleotide 1081 to about nucleotide 1127; the fragment of SEQ ID NO:155 from about nucleotide 31 to about nucleotide 77; the fragment of SEQ ID NO:156 from about nucleotide 157 to about nucleotide 201; the
15 fragment of SEQ ID NO:157 from about nucleotide 216 to about nucleotide 259; and the fragment of SEQ ID NO:158 from about nucleotide 517 to about nucleotide 561. The polypeptides encoded by these fragments may be useful, for example, as antigenic polypeptides.

The invention also encompasses HTMPN variants. A preferred HTMPN variant is
20 one which has at least about 80%, more preferably at least about 90%, and most preferably at least about 95% amino acid sequence identity to the HTMPN amino acid sequence, and which contains at least one functional or structural characteristic of HTMPN.

The invention also encompasses polynucleotides which encode HTMPN. In a particular embodiment, the invention encompasses a polynucleotide sequence comprising
25 a sequence selected from the group consisting of SEQ ID NO:80-158, which encodes HTMPN.

The invention also encompasses a variant of a polynucleotide sequence encoding HTMPN. In particular, such a variant polynucleotide sequence will have at least about 80%, more preferably at least about 90%, and most preferably at least about 95%
30 polynucleotide sequence identity to the polynucleotide sequence encoding HTMPN. A particular aspect of the invention encompasses a variant of a polynucleotide sequence comprising a sequence selected from the group consisting of SEQ ID NO:80-158 which

has at least about 80%, more preferably at least about 90%, and most preferably at least about 95% polynucleotide sequence identity to a nucleic acid sequence selected from the group consisting of SEQ ID NO:80-158. Any one of the polynucleotide variants described above can encode an amino acid sequence which contains at least one functional or structural characteristic of HTMPN.

It will be appreciated by those skilled in the art that as a result of the degeneracy of the genetic code, a multitude of polynucleotide sequences encoding HTMPN, some bearing minimal similarity to the polynucleotide sequences of any known and naturally occurring gene, may be produced. Thus, the invention contemplates each and every possible variation of polynucleotide sequence that could be made by selecting combinations based on possible codon choices. These combinations are made in accordance with the standard triplet genetic code as applied to the polynucleotide sequence of naturally occurring HTMPN, and all such variations are to be considered as being specifically disclosed.

Although nucleotide sequences which encode HTMPN and its variants are preferably capable of hybridizing to the nucleotide sequence of the naturally occurring HTMPN under appropriately selected conditions of stringency, it may be advantageous to produce nucleotide sequences encoding HTMPN or its derivatives possessing a substantially different codon usage, e.g., inclusion of non-naturally occurring codons. Codons may be selected to increase the rate at which expression of the peptide occurs in a particular prokaryotic or eukaryotic host in accordance with the frequency with which particular codons are utilized by the host. Other reasons for substantially altering the nucleotide sequence encoding HTMPN and its derivatives without altering the encoded amino acid sequences include the production of RNA transcripts having more desirable properties, such as a greater half-life, than transcripts produced from the naturally occurring sequence.

The invention also encompasses production of DNA sequences which encode HTMPN and HTMPN derivatives, or fragments thereof, entirely by synthetic chemistry. After production, the synthetic sequence may be inserted into any of the many available expression vectors and cell systems using reagents well known in the art. Moreover, synthetic chemistry may be used to introduce mutations into a sequence encoding HTMPN or any fragment thereof.

Also encompassed by the invention are polynucleotide sequences that are capable of hybridizing to the claimed polynucleotide sequences, and, in particular, to those shown in SEQ ID NO:80-158 and fragments thereof under various conditions of stringency. (See, e.g., Wahl, G.M. and S.L. Berger (1987) *Methods Enzymol.* 152:399-407; Kimmel, A.R. (1987) *Methods Enzymol.* 152:507-511.) For example, stringent salt concentration will ordinarily be less than about 750 mM NaCl and 75 mM trisodium citrate, preferably less than about 500 mM NaCl and 50 mM trisodium citrate, and most preferably less than about 250 mM NaCl and 25 mM trisodium citrate. Low stringency hybridization can be obtained in the absence of organic solvent, e.g., formamide, while high stringency hybridization can be obtained in the presence of at least about 35% formamide, and most preferably at least about 50% formamide. Stringent temperature conditions will ordinarily include temperatures of at least about 30°C, more preferably of at least about 37°C, and most preferably of at least about 42°C. Varying additional parameters, such as hybridization time, the concentration of detergent, e.g., sodium dodecyl sulfate (SDS), and the inclusion or exclusion of carrier DNA, are well known to those skilled in the art. Various levels of stringency are accomplished by combining these various conditions as needed. In a preferred embodiment, hybridization will occur at 30°C in 750 mM NaCl, 75 mM trisodium citrate, and 1% SDS. In a more preferred embodiment, hybridization will occur at 37°C in 500 mM NaCl, 50 mM trisodium citrate, 1% SDS, 35% formamide, and 100 µg/ml denatured salmon sperm DNA (ssDNA). In a most preferred embodiment, hybridization will occur at 42°C in 250 mM NaCl, 25 mM trisodium citrate, 1% SDS, 50 % formamide, and 200 µg/ml ssDNA. Useful variations on these conditions will be readily apparent to those skilled in the art.

The washing steps which follow hybridization can also vary in stringency. Wash stringency conditions can be defined by salt concentration and by temperature. As above, wash stringency can be increased by decreasing salt concentration or by increasing temperature. For example, stringent salt concentration for the wash steps will preferably be less than about 30 mM NaCl and 3 mM trisodium citrate, and most preferably less than about 15 mM NaCl and 1.5 mM trisodium citrate. Stringent temperature conditions for the wash steps will ordinarily include temperature of at least about 25°C, more preferably of at least about 42°C, and most preferably of at least about 68°C. In a preferred embodiment, wash steps will occur at 25°C in 30 mM NaCl, 3 mM trisodium citrate, and 0.1% SDS. In

a more preferred embodiment, wash steps will occur at 42°C in 15 mM NaCl, 1.5 mM trisodium citrate, and 0.1% SDS. In a most preferred embodiment, wash steps will occur at 68°C in 15 mM NaCl, 1.5 mM trisodium citrate, and 0.1% SDS. Additional variations on these conditions will be readily apparent to those skilled in the art.

5 Methods for DNA sequencing are well known in the art and may be used to practice any of the embodiments of the invention. The methods may employ such enzymes as the Klenow fragment of DNA polymerase I, SEQUENASE (US Biochemical, Cleveland OH), Taq polymerase (Perkin-Elmer), thermostable T7 polymerase (Amersham Pharmacia Biotech, Piscataway NJ), or combinations of polymerases and proofreading
10 exonucleases such as those found in the ELONGASE amplification system (Life Technologies, Gaithersburg MD). Preferably, sequence preparation is automated with machines such as the Hamilton MICROLAB 2200 (Hamilton, Reno NV), Peltier Thermal Cycler 200 (PTC200; MJ Research, Watertown MA) and the ABI CATALYST 800 (Perkin-Elmer). Sequencing is then carried out using either ABI 373 or 377 DNA
15 sequencing systems (Perkin-Elmer) or the MEGABACE 1000 DNA sequencing system (Molecular Dynamics, Sunnyvale CA). The resulting sequences are analyzed using a variety of algorithms which are well known in the art. (See, e.g., Ausubel, F.M. (1997) Short Protocols in Molecular Biology, John Wiley & Sons, New York NY, unit 7.7; Meyers, R.A. (1995) Molecular Biology and Biotechnology, Wiley VCH, New York NY,
20 pp. 856-853.)

The nucleic acid sequences encoding HTMPN may be extended utilizing a partial nucleotide sequence and employing various PCR-based methods known in the art to detect upstream sequences, such as promoters and regulatory elements. For example, one method which may be employed, restriction-site PCR, uses universal and nested primers to
25 amplify unknown sequence from genomic DNA within a cloning vector. (See, e.g., Sarkar, G. (1993) PCR Methods Applic. 2:318-322.) Another method, inverse PCR, uses primers that extend in divergent directions to amplify unknown sequence from a circularized template. The template is derived from restriction fragments comprising a known genomic locus and surrounding sequences. (See, e.g., Triglia, T. et al. (1988)
30 Nucleic Acids Res. 16:8186.) A third method, capture PCR, involves PCR amplification of DNA fragments adjacent to known sequences in human and yeast artificial chromosome DNA. (See, e.g., Lagerstrom, M. et al. (1991) PCR Methods Applic. 1:111-119.) In this

method, multiple restriction enzyme digestions and ligations may be used to insert an engineered double-stranded sequence into a region of unknown sequence before performing PCR. Other methods which may be used to retrieve unknown sequences are known in the art. (See, e.g., Parker, J.D. et al. (1991) Nucleic Acids Res. 19:3055-306).

5 Additionally, one may use PCR, nested primers, and PROMOTERFINDER libraries (Clontech, Palo Alto CA) to walk genomic DNA. This procedure avoids the need to screen libraries and is useful in finding intron/exon junctions. For all PCR-based methods, primers may be designed using commercially available software, such as OLIGO 4.06 Primer Analysis software (National Biosciences, Plymouth MN) or another appropriate

10 program, to be about 22 to 30 nucleotides in length, to have a GC content of about 50% or more, and to anneal to the template at temperatures of about 68°C to 72°C.

When screening for full-length cDNAs, it is preferable to use libraries that have been size-selected to include larger cDNAs. In addition, random-primed libraries, which often include sequences containing the 5' regions of genes, are preferable for situations in

15 which an oligo d(T) library does not yield a full-length cDNA. Genomic libraries may be useful for extension of sequence into 5' non-transcribed regulatory regions.

Capillary electrophoresis systems which are commercially available may be used to analyze the size or confirm the nucleotide sequence of sequencing or PCR products. In particular, capillary sequencing may employ flowable polymers for electrophoretic

20 separation, four different nucleotide-specific, laser-stimulated fluorescent dyes, and a charge coupled device camera for detection of the emitted wavelengths. Output/light intensity may be converted to electrical signal using appropriate software (e.g., GENOTYPER and SEQUENCE NAVIGATOR, Perkin-Elmer), and the entire process from loading of samples to computer analysis and electronic data display may be computer

25 controlled. Capillary electrophoresis is especially preferable for sequencing small DNA fragments which may be present in limited amounts in a particular sample.

In another embodiment of the invention, polynucleotide sequences or fragments thereof which encode HTMPN may be cloned in recombinant DNA molecules that direct expression of HTMPN, or fragments or functional equivalents thereof, in appropriate host

30 cells. Due to the inherent degeneracy of the genetic code, other DNA sequences which encode substantially the same or a functionally equivalent amino acid sequence may be produced and used to express HTMPN.

The nucleotide sequences of the present invention can be engineered using methods generally known in the art in order to alter HTMPN-encoding sequences for a variety of purposes including, but not limited to, modification of the cloning, processing, and/or expression of the gene product. DNA shuffling by random fragmentation and PCR
5 reassembly of gene fragments and synthetic oligonucleotides may be used to engineer the nucleotide sequences. For example, oligonucleotide-mediated site-directed mutagenesis may be used to introduce mutations that create new restriction sites, alter glycosylation patterns, change codon preference, produce splice variants, and so forth.

In another embodiment, sequences encoding HTMPN may be synthesized, in
10 whole or in part, using chemical methods well known in the art. (See, e.g., Caruthers, M.H. et al. (1980) Nucl. Acids Res. Symp. Ser. 215-223, and Horn, T. et al. (1980) Nucl. Acids Res. Symp. Ser. 225-232.) Alternatively, HTMPN itself or a fragment thereof may be synthesized using chemical methods. For example, peptide synthesis can be performed using various solid-phase techniques. (See, e.g., Roberge, J.Y. et al. (1995) Science
15 269:202-204.) Automated synthesis may be achieved using the ABI 431A Peptide Synthesizer (Perkin-Elmer). Additionally, the amino acid sequence of HTMPN, or any part thereof, may be altered during direct synthesis and/or combined with sequences from other proteins, or any part thereof, to produce a variant polypeptide.

The peptide may be substantially purified by preparative high performance liquid
20 chromatography. (See, e.g., Chiez, R.M. and F.Z. Regnier (1990) Methods Enzymol. 182:392-421.) The composition of the synthetic peptides may be confirmed by amino acid analysis or by sequencing. (See, e.g., Creighton, T. (1984) Proteins, Structures and Molecular Properties, WH Freeman, New York NY.)

In order to express a biologically active HTMPN, the nucleotide sequences
25 encoding HTMPN or derivatives thereof may be inserted into an appropriate expression vector, i.e., a vector which contains the necessary elements for transcriptional and translational control of the inserted coding sequence in a suitable host. These elements include regulatory sequences, such as enhancers, constitutive and inducible promoters, and 5' and 3' untranslated regions in the vector and in polynucleotide sequences encoding
30 HTMPN. Such elements may vary in their strength and specificity. Specific initiation signals may also be used to achieve more efficient translation of sequences encoding HTMPN. Such signals include the ATG initiation codon and adjacent sequences, e.g. the

Kozak sequence. In cases where sequences encoding HTMPN and its initiation codon and upstream regulatory sequences are inserted into the appropriate expression vector, no additional transcriptional or translational control signals may be needed. However, in cases where only coding sequence, or a fragment thereof, is inserted, exogenous

- 5 translational control signals including an in-frame ATG initiation codon should be provided by the vector. Exogenous translational elements and initiation codons may be of various origins, both natural and synthetic. The efficiency of expression may be enhanced by the inclusion of enhancers appropriate for the particular host cell system used. (See, e.g., Scharf, D. et al. (1994) *Results Probl. Cell Differ.* 20:125-162.)

- 10 Methods which are well known to those skilled in the art may be used to construct expression vectors containing sequences encoding HTMPN and appropriate transcriptional and translational control elements. These methods include in vitro recombinant DNA techniques, synthetic techniques, and in vivo genetic recombination. (See, e.g., Sambrook, J. et al. (1989) Molecular Cloning, A Laboratory Manual, Cold Spring Harbor Press, Plainview NY, ch. 4, 8, and 16-17; Ausubel, F.M. et al. (1995) Current Protocols in Molecular Biology, John Wiley & Sons, New York NY, ch. 9, 13, and 16.)

A variety of expression vector/host systems may be utilized to contain and express sequences encoding HTMPN. These include, but are not limited to, microorganisms such as bacteria transformed with recombinant bacteriophage, plasmid, or cosmid DNA

- 20 expression vectors; yeast transformed with yeast expression vectors; insect cell systems infected with viral expression vectors (e.g., baculovirus); plant cell systems transformed with viral expression vectors (e.g., cauliflower mosaic virus, CaMV, or tobacco mosaic virus, TMV) or with bacterial expression vectors (e.g., Ti or pBR322 plasmids); or animal cell systems. The invention is not limited by the host cell employed.

- 25 In bacterial systems, a number of cloning and expression vectors may be selected depending upon the use intended for polynucleotide sequences encoding HTMPN. For example, routine cloning, subcloning, and propagation of polynucleotide sequences encoding HTMPN can be achieved using a multifunctional E. coli vector such as PBLUESCRIPT (Stratagene, La Jolla CA) or pSPORT1 plasmid (Life Technologies).

- 30 Ligation of sequences encoding HTMPN into the vector's multiple cloning site disrupts the *lacZ* gene, allowing a colorimetric screening procedure for identification of transformed bacteria containing recombinant molecules. In addition, these vectors may be

useful for in vitro transcription, dideoxy sequencing, single strand rescue with helper phage, and creation of nested deletions in the cloned sequence. (See, e.g., Van Heeke, G. and S.M. Schuster (1989) J. Biol. Chem. 264:5503-5509.) When large quantities of HTMPN are needed, e.g. for the production of antibodies, vectors which direct high level expression of HTMPN may be used. For example, vectors containing the strong, inducible T5 or T7 bacteriophage promoter may be used.

Yeast expression systems may be used for production of HTMPN. A number of vectors containing constitutive or inducible promoters, such as alpha factor, alcohol oxidase, and PGH, may be used in the yeast Saccharomyces cerevisiae or Pichia pastoris. In addition, such vectors direct either the secretion or intracellular retention of expressed proteins and enable integration of foreign sequences into the host genome for stable propagation. (See, e.g., Ausubel, 1995, supra; Grant et al. (1987) Methods Enzymol. 153:516-54; and Scorer, C. A. et al. (1994) Bio/Technology 12:181-184.)

Plant systems may also be used for expression of HTMPN. Transcription of sequences encoding HTMPN may be driven viral promoters, e.g., the 35S and 19S promoters of CaMV used alone or in combination with the omega leader sequence from TMV (Takamatsu, N. (1987) EMBO J. 6:307-311). Alternatively, plant promoters such as the small subunit of RUBISCO or heat shock promoters may be used. (See, e.g., Coruzzi, G. et al. (1984) EMBO J. 3:1671-1680; Broglie, R. et al. (1984) Science 224:838-843; and Winter, J. et al. (1991) Results Probl. Cell Differ. 17:85-105.) These constructs can be introduced into plant cells by direct DNA transformation or pathogen-mediated transfection. (See, e.g., The McGraw Hill Yearbook of Science and Technology (1992) McGraw Hill, New York NY, pp. 191-196.)

In mammalian cells, a number of viral-based expression systems may be utilized. In cases where an adenovirus is used as an expression vector, sequences encoding HTMPN may be ligated into an adenovirus transcription/translation complex consisting of the late promoter and tripartite leader sequence. Insertion in a non-essential E1 or E3 region of the viral genome may be used to obtain infective virus which expresses HTMPN in host cells. (See, e.g., Logan, J. and T. Shenk (1984) Proc. Natl. Acad. Sci. 81:3655-3659.) In addition, transcription enhancers, such as the Rous sarcoma virus (RSV) enhancer, may be used to increase expression in mammalian host cells. SV40 or EBV-based vectors may also be used for high-level protein expression.

Human artificial chromosomes (HACs) may also be employed to deliver larger fragments of DNA than can be contained in and expressed from a plasmid. HACs of about 6 kb to 10 Mb are constructed and delivered via conventional delivery methods (liposomes, polycationic amino polymers, or vesicles) for therapeutic purposes. (See, e.g.,
5 Harrington, J.J. et al. (1997) Nat Genet. 15:345-355.)

For long term production of recombinant proteins in mammalian systems, stable expression of HTMPN in cell lines is preferred. For example, sequences encoding HTMPN can be transformed into cell lines using expression vectors which may contain viral origins of replication and/or endogenous expression elements and a selectable marker
10 gene on the same or on a separate vector. Following the introduction of the vector, cells may be allowed to grow for about 1 to 2 days in enriched media before being switched to selective media. The purpose of the selectable marker is to confer resistance to a selective agent, and its presence allows growth and recovery of cells which successfully express the introduced sequences. Resistant clones of stably transformed cells may be propagated
15 using tissue culture techniques appropriate to the cell type.

Any number of selection systems may be used to recover transformed cell lines. These include, but are not limited to, the herpes simplex virus thymidine kinase and adenine phosphoribosyltransferase genes, for use in *tk* or *apr*⁻ cells, respectively. (See, e.g., Wigler, M. et al. (1977) Cell 11:223-232; Lowy, I. et al. (1980) Cell 22:817-823.)
20 Also, antimetabolite, antibiotic, or herbicide resistance can be used as the basis for selection. For example, *dhfr* confers resistance to methotrexate; *neo* confers resistance to the aminoglycosides, neomycin and G-418; and *als* or *pat* confer resistance to chlorsulfuron and phosphinotricin acetyltransferase, respectively. (See, e.g., Wigler, M. et al. (1980) Proc. Natl. Acad. Sci. 77:3567-3570; Colbere-Garapin, F. et al. (1981) J. Mol.
25 Biol. 150:1-14.) Additional selectable genes have been described, e.g., *trpB* and *hisD*, which alter cellular requirements for metabolites. (See, e.g., Hartman, S.C. and R.C. Mulligan (1988) Proc. Natl. Acad. Sci. 85:8047-8051.) Visible markers, e.g., anthocyanins, green fluorescent proteins (GFP; Clontech), β glucuronidase and its substrate β -glucuronide, or luciferase and its substrate luciferin may be used. These
30 markers can be used not only to identify transformants, but also to quantify the amount of transient or stable protein expression attributable to a specific vector system. (See, e.g., Rhodes, C.A. (1995) Methods Mol. Biol. 55:121-131.)

Although the presence/absence of marker gene expression suggests that the gene of interest is also present, the presence and expression of the gene may need to be confirmed. For example, if the sequence encoding HTMPN is inserted within a marker gene sequence, transformed cells containing sequences encoding HTMPN can be identified by the absence
5 of marker gene function. Alternatively, a marker gene can be placed in tandem with a sequence encoding HTMPN under the control of a single promoter. Expression of the marker gene in response to induction or selection usually indicates expression of the tandem gene as well.

In general, host cells that contain the nucleic acid sequence encoding HTMPN and
10 that express HTMPN may be identified by a variety of procedures known to those of skill in the art. These procedures include, but are not limited to, DNA-DNA or DNA-RNA hybridizations, PCR amplification, and protein bioassay or immunoassay techniques which include membrane, solution, or chip based technologies for the detection and/or quantification of nucleic acid or protein sequences.

15 Immunological methods for detecting and measuring the expression of HTMPN using either specific polyclonal or monoclonal antibodies are known in the art. Examples of such techniques include enzyme-linked immunosorbent assays (ELISAs), radioimmunoassays (RIAs), and fluorescence activated cell sorting (FACS). A two-site, monoclonal-based immunoassay utilizing monoclonal antibodies reactive to two
20 non-interfering epitopes on HTMPN is preferred, but a competitive binding assay may be employed. These and other assays are well known in the art. (See, e.g., Hampton, R. et al. (1990) Serological Methods, a Laboratory Manual, APS Press, St Paul MN, Sect. IV; Coligan, J. E. et al. (1997) Current Protocols in Immunology, Greene Pub. Associates and Wiley-Interscience, New York NY; and Pound, J.D. (1998) Immunochemical Protocols,
25 Humana Press, Totowa NJ).

A wide variety of labels and conjugation techniques are known by those skilled in the art and may be used in various nucleic acid and amino acid assays. Means for producing labeled hybridization or PCR probes for detecting sequences related to polynucleotides encoding HTMPN include oligolabeling, nick translation, end-labeling, or
30 PCR amplification using a labeled nucleotide. Alternatively, the sequences encoding HTMPN, or any fragments thereof, may be cloned into a vector for the production of an mRNA probe. Such vectors are known in the art, are commercially available, and may be

used to synthesize RNA probes in vitro by addition of an appropriate RNA polymerase such as T7, T3, or SP6 and labeled nucleotides. These procedures may be conducted using a variety of commercially available kits, such as those provided by Amersham Pharmacia Biotech, Promega (Madison WI), and US Biochemical. Suitable reporter molecules or
5 labels which may be used for ease of detection include radionuclides, enzymes, fluorescent, chemiluminescent, or chromogenic agents, as well as substrates, cofactors, inhibitors, magnetic particles, and the like.

Host cells transformed with nucleotide sequences encoding HTMPN may be cultured under conditions suitable for the expression and recovery of the protein from cell
10 culture. The protein produced by a transformed cell may be secreted or retained intracellularly depending on the sequence and/or the vector used. As will be understood by those of skill in the art, expression vectors containing polynucleotides which encode HTMPN may be designed to contain signal sequences which direct secretion of HTMPN through a prokaryotic or eukaryotic cell membrane.

15 In addition, a host cell strain may be chosen for its ability to modulate expression of the inserted sequences or to process the expressed protein in the desired fashion. Such modifications of the polypeptide include, but are not limited to, acetylation, carboxylation, glycosylation, phosphorylation, lipidation, and acylation. Post-translational processing which cleaves a "prepro" form of the protein may also be used to specify protein targeting,
20 folding, and/or activity. Different host cells which have specific cellular machinery and characteristic mechanisms for post-translational activities (e.g., CHO, HeLa, MDCK, HEK293, and WI38), are available from the American Type Culture Collection (ATCC, Bethesda MD) and may be chosen to ensure the correct modification and processing of the foreign protein.

25 In another embodiment of the invention, natural, modified, or recombinant nucleic acid sequences encoding HTMPN may be ligated to a heterologous sequence resulting in translation of a fusion protein in any of the aforementioned host systems. For example, a chimeric HTMPN protein containing a heterologous moiety that can be recognized by a commercially available antibody may facilitate the screening of peptide libraries for
30 inhibitors of HTMPN activity. Heterologous protein and peptide moieties may also facilitate purification of fusion proteins using commercially available affinity matrices. Such moieties include, but are not limited to, glutathione S-transferase (GST), maltose

binding protein (MBP), thioredoxin (Trx), calmodulin binding peptide (CBP), 6-His, FLAG, *c-myc*, and hemagglutinin (HA). GST, MBP, Trx, CBP, and 6-His enable purification of their cognate fusion proteins on immobilized glutathione, maltose, phenylarsine oxide, calmodulin, and metal-chelate resins, respectively. FLAG, *c-myc*, and hemagglutinin (HA) enable immunoaffinity purification of fusion proteins using commercially available monoclonal and polyclonal antibodies that specifically recognize these epitope tags. A fusion protein may also be engineered to contain a proteolytic cleavage site located between the HTMPN encoding sequence and the heterologous protein sequence, so that HTMPN may be cleaved away from the heterologous moiety following purification. Methods for fusion protein expression and purification are discussed in Ausubel (1995, supra, ch 10). A variety of commercially available kits may also be used to facilitate expression and purification of fusion proteins.

In a further embodiment of the invention, synthesis of radiolabeled HTMPN may be achieved in vitro using the TNT rabbit reticulocyte lysate or wheat germ extract systems (Promega). These systems couple transcription and translation of protein-coding sequences operably associated with the T7, T3, or SP6 promoters. Translation takes place in the presence of a radiolabeled amino acid precursor, preferably ³⁵S-methionine.

Fragments of HTMPN may be produced not only by recombinant production, but also by direct peptide synthesis using solid-phase techniques. (See, e.g., Creighton, supra pp. 55-60.) Protein synthesis may be performed by manual techniques or by automation. Automated synthesis may be achieved, for example, using the ABI 431A Peptide Synthesizer (Perkin-Elmer). Various fragments of HTMPN may be synthesized separately and then combined to produce the full length molecule.

THERAPEUTICS

Chemical and structural similarity, e.g., in the context of sequences and motifs, exists between regions of HTMPN and human transmembrane proteins. In addition, the expression of HTMPN is closely associated with tissue involved in inflammation and the immune response and with cell proliferative conditions including cancer, and in reproductive, gastrointestinal, fetal, smooth muscle, cardiovascular, developmental, and nervous tissue. Therefore, HTMPN appears to play a role in immune, reproductive, smooth muscle, neurological, gastrointestinal, developmental, and cell proliferative disorders. In the treatment of immune, reproductive, smooth muscle, neurological,

gastrointestinal, developmental, and cell proliferative disorders associated with increased HTMPN expression or activity, it is desirable to decrease the expression or activity of HTMPN. In the treatment of the above conditions associated with decreased HTMPN expression or activity, it is desirable to increase the expression or activity of HTMPN.

- 5 Therefore, in one embodiment, HTMPN or a fragment or derivative thereof may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of HTMPN. Examples of such disorders include, but are not limited to, an immune disorder such as acquired immunodeficiency syndrome (AIDS), Addison's disease, adult respiratory distress syndrome, allergies, ankylosing spondylitis, amyloidosis,
- 10 anemia, asthma, atherosclerosis, autoimmune hemolytic anemia, autoimmune thyroiditis, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), bronchitis, cholecystitis, contact dermatitis, Crohn's disease, atopic dermatitis, dermatomyositis, diabetes mellitus, emphysema, episodic lymphopenia with lymphocytotoxins, erythroblastosis fetalis, erythema nodosum, atrophic gastritis,
- 15 glomerulonephritis, Goodpasture's syndrome, gout, Graves' disease, Hashimoto's thyroiditis, hypereosinophilia, irritable bowel syndrome, multiple sclerosis, myasthenia gravis, myocardial or pericardial inflammation, osteoarthritis, osteoporosis, pancreatitis, polymyositis, psoriasis, Reiter's syndrome, rheumatoid arthritis, scleroderma, Sjögren's syndrome, systemic anaphylaxis, systemic lupus erythematosus, systemic sclerosis,
- 20 thrombocytopenic purpura, ulcerative colitis, uveitis, Werner syndrome, complications of cancer, hemodialysis, and extracorporeal circulation, viral, bacterial, fungal, parasitic, protozoal, and helminthic infections, and trauma; a reproductive disorder such as a disorder of prolactin production; infertility, including tubal disease, ovulatory defects, and endometriosis; a disruption of the estrous cycle, a disruption of the menstrual cycle,
- 25 polycystic ovary syndrome, ovarian hyperstimulation syndrome, endometrial and ovarian tumors, uterine fibroids, autoimmune disorders, ectopic pregnancies, and teratogenesis; cancer of the breast, fibrocystic breast disease, and galactorrhea; disruptions of spermatogenesis, abnormal sperm physiology, cancer of the testis, cancer of the prostate, benign prostatic hyperplasia, prostatitis, Peyronie's disease, impotence, carcinoma of the
- 30 male breast, and gynecomastia; a smooth muscle disorder such as angina, anaphylactic shock, arrhythmias, asthma, cardiovascular shock, Cushing's syndrome, hypertension, hypoglycemia, myocardial infarction, migraine, and pheochromocytoma, and myopathies

- including cardiomyopathy, encephalopathy, epilepsy, Kearns-Sayre syndrome, lactic acidosis, myoclonic disorder, and ophthalmoplegia; a neurological disorder such as epilepsy, ischemic cerebrovascular disease, stroke, cerebral neoplasms, Alzheimer's disease, Pick's disease, Huntington's disease, dementia, Parkinson's disease and other
- 5 extrapyramidal disorders, amyotrophic lateral sclerosis and other motor neuron disorders, progressive neural muscular atrophy, retinitis pigmentosa, hereditary ataxias, multiple sclerosis and other demyelinating diseases, bacterial and viral meningitis, brain abscess, subdural empyema, epidural abscess, suppurative intracranial thrombophlebitis, myelitis and radiculitis, viral central nervous system disease; prion diseases including kuru,
- 10 Creutzfeldt-Jakob disease, and Gerstmann-Straussler-Scheinker syndrome; fatal familial insomnia, nutritional and metabolic diseases of the nervous system, neurofibromatosis, tuberous sclerosis, cerebelloretinal hemangioblastomatosis, encephalotrigeminal syndrome, mental retardation and other developmental disorders of the central nervous system, cerebral palsy, neuroskeletal disorders, autonomic nervous system disorders,
- 15 cranial nerve disorders, spinal cord diseases, muscular dystrophy and other neuromuscular disorders, peripheral nervous system disorders, dermatomyositis and polymyositis; inherited, metabolic, endocrine, and toxic myopathies; myasthenia gravis, periodic paralysis; mental disorders including mood, anxiety, and schizophrenic disorders; akathisia, amnesia, catatonia, diabetic neuropathy, tardive dyskinesia, dystonias, paranoid
- 20 psychoses, postherpetic neuralgia, and Tourette's disorder; a gastrointestinal disorder such as dysphagia, peptic esophagitis, esophageal spasm, esophageal stricture, esophageal carcinoma, dyspepsia, indigestion, gastritis, gastric carcinoma, anorexia, nausea, emesis, gastroparesis, antral or pyloric edema, abdominal angina, pyrosis, gastroenteritis, intestinal obstruction, infections of the intestinal tract, peptic ulcer, cholelithiasis, cholecystitis,
- 25 cholestasis, pancreatitis, pancreatic carcinoma, biliary tract disease, hepatoma, infectious colitis, ulcerative colitis, ulcerative proctitis, Crohn's disease, Whipple's disease, Mallory-Weiss syndrome, colonic carcinoma, colonic obstruction, irritable bowel syndrome, short bowel syndrome, diarrhea, constipation, gastrointestinal hemorrhage, and acquired immunodeficiency syndrome (AIDS) enteropathy, cirrhosis, jaundice, cholestasis,
- 30 hereditary hyperbilirubinemia, hepatic encephalopathy, hepatorenal syndrome, hepatitis, hepatic steatosis, hemochromatosis, Wilson's disease, α_1 -antitrypsin deficiency, Reye's syndrome, primary sclerosing cholangitis, liver infarction, portal vein obstruction and

thrombosis, passive congestion, centrilobular necrosis, peliosis hepatis, hepatic vein thrombosis, veno-occlusive disease, preeclampsia, eclampsia, acute fatty liver of pregnancy, intrahepatic cholestasis of pregnancy, and hepatic tumors including nodular hyperplasias, adenomas, and carcinomas; a cell proliferative disorder such as actinic keratosis, arteriosclerosis, atherosclerosis, bursitis, cirrhosis, hepatitis, mixed connective tissue disease (MCTD), myelofibrosis, paroxysmal nocturnal hemoglobinuria, polycythemia vera, psoriasis, primary thrombocythemia, and cancers including adenocarcinoma, leukemia, lymphoma, melanoma, myeloma, sarcoma, teratocarcinoma, and, in particular, cancers of the adrenal gland, bladder, bone, bone marrow, brain, breast, cervix, gall bladder, ganglia, gastrointestinal tract, heart, kidney, liver, lung, muscle, ovary, pancreas, parathyroid, penis, prostate, salivary glands, skin, spleen, testis, thymus, thyroid, and uterus; and a developmental disorder including, but not limited to, those listed above.

In another embodiment, a vector capable of expressing HTMPN or a fragment or derivative thereof may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of HTMPN including, but not limited to, those described above.

In a further embodiment, a pharmaceutical composition comprising a substantially purified HTMPN in conjunction with a suitable pharmaceutical carrier may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of HTMPN including, but not limited to, those provided above.

In still another embodiment, an agonist which modulates the activity of HTMPN may be administered to a subject to treat or prevent a disorder associated with decreased expression or activity of HTMPN including, but not limited to, those listed above.

In a further embodiment, an antagonist of HTMPN may be administered to a subject to treat or prevent a disorder associated with increased expression or activity of HTMPN. Examples of such disorders include, but are not limited to, those described above. In one aspect, an antibody which specifically binds HTMPN may be used directly as an antagonist or indirectly as a targeting or delivery mechanism for bringing a pharmaceutical agent to cells or tissue which express HTMPN.

In an additional embodiment, a vector expressing the complement of the polynucleotide encoding HTMPN may be administered to a subject to treat or prevent a disorder associated with increased expression or activity of HTMPN including, but not

limited to, those described above.

In other embodiments, any of the proteins, antagonists, antibodies, agonists, complementary sequences, or vectors of the invention may be administered in combination with other appropriate therapeutic agents. Selection of the appropriate agents for use in combination therapy may be made by one of ordinary skill in the art, according to conventional pharmaceutical principles. The combination of therapeutic agents may act synergistically to effect the treatment or prevention of the various disorders described above. Using this approach, one may be able to achieve therapeutic efficacy with lower dosages of each agent, thus reducing the potential for adverse side effects.

An antagonist of HTMPN may be produced using methods which are generally known in the art. In particular, purified HTMPN may be used to produce antibodies or to screen libraries of pharmaceutical agents to identify those which specifically bind HTMPN. Antibodies to HTMPN may also be generated using methods that are well known in the art. Such antibodies may include, but are not limited to, polyclonal, monoclonal, chimeric, and single chain antibodies, Fab fragments, and fragments produced by a Fab expression library. Neutralizing antibodies (i.e., those which inhibit dimer formation) are especially preferred for therapeutic use.

For the production of antibodies, various hosts including goats, rabbits, rats, mice, humans, and others may be immunized by injection with HTMPN or with any fragment or oligopeptide thereof which has immunogenic properties. Depending on the host species, various adjuvants may be used to increase immunological response. Such adjuvants include, but are not limited to, Freund's, mineral gels such as aluminum hydroxide, and surface active substances such as lysolecithin, pluronic polyols, polyanions, peptides, oil emulsions, KLH, and dinitrophenol. Among adjuvants used in humans, BCG (bacilli Calmette-Guerin) and Corynebacterium parvum are especially preferable.

It is preferred that the oligopeptides, peptides, or fragments used to induce antibodies to HTMPN have an amino acid sequence consisting of at least about 5 amino acids, and, more preferably, of at least about 10 amino acids. It is also preferable that these oligopeptides, peptides, or fragments are identical to a portion of the amino acid sequence of the natural protein and contain the entire amino acid sequence of a small, naturally occurring molecule. Short stretches of HTMPN amino acids may be fused with those of another protein, such as KLH, and antibodies to the chimeric molecule may be

produced.

Monoclonal antibodies to HTMPN may be prepared using any technique which provides for the production of antibody molecules by continuous cell lines in culture. These include, but are not limited to, the hybridoma technique, the human B-cell hybridoma technique, and the EBV-hybridoma technique. (See, e.g., Kohler, G. et al. (1975) *Nature* 256:495-497; Kozbor, D. et al. (1985) *J. Immunol. Methods* 81:31-42; Cote, R.J. et al. (1983) *Proc. Natl. Acad. Sci.* 80:2026-2030; and Cole, S.P. et al. (1984) *Mol. Cell Biol.* 62:109-120.)

In addition, techniques developed for the production of "chimeric antibodies," such as the splicing of mouse antibody genes to human antibody genes to obtain a molecule with appropriate antigen specificity and biological activity, can be used. (See, e.g., Morrison, S.L. et al. (1984) *Proc. Natl. Acad. Sci.* 81:6851-6855; Neuberger, M.S. et al. (1984) *Nature* 312:604-608; and Takeda, S. et al. (1985) *Nature* 314:452-454.) Alternatively, techniques described for the production of single chain antibodies may be adapted, using methods known in the art, to produce HTMPN-specific single chain antibodies. Antibodies with related specificity, but of distinct idiotypic composition, may be generated by chain shuffling from random combinatorial immunoglobulin libraries. (See, e.g., Burton D.R. (1991) *Proc. Natl. Acad. Sci.* 88:10134-10137.)

Antibodies may also be produced by inducing in vivo production in the lymphocyte population or by screening immunoglobulin libraries or panels of highly specific binding reagents as disclosed in the literature. (See, e.g., Orlandi, R. et al. (1989) *Proc. Natl. Acad. Sci.* 86: 3833-3837; Winter, G. et al. (1991) *Nature* 349:293-299.)

Antibody fragments which contain specific binding sites for HTMPN may also be generated. For example, such fragments include, but are not limited to, F(ab')₂ fragments produced by pepsin digestion of the antibody molecule and Fab fragments generated by reducing the disulfide bridges of the F(ab')₂ fragments. Alternatively, Fab expression libraries may be constructed to allow rapid and easy identification of monoclonal Fab fragments with the desired specificity. (See, e.g., Huse, W.D. et al. (1989) *Science* 246:1275-1281.)

Various immunoassays may be used for screening to identify antibodies having the desired specificity. Numerous protocols for competitive binding or immunoradiometric assays using either polyclonal or monoclonal antibodies with established specificities are

well known in the art. Such immunoassays typically involve the measurement of complex formation between HTMPN and its specific antibody. A two-site, monoclonal-based immunoassay utilizing monoclonal antibodies reactive to two non-interfering HTMPN epitopes is preferred, but a competitive binding assay may also be employed (Pound, 5 supra).

Various methods such as Scatchard analysis in conjunction with radioimmunoassay techniques may be used to assess the affinity of antibodies for HTMPN. Affinity is expressed as an association constant, K_a , which is defined as the molar concentration of HTMPN-antibody complex divided by the molar concentrations of free antigen and free 10 antibody under equilibrium conditions. The K_a determined for a preparation of polyclonal antibodies, which are heterogeneous in their affinities for multiple HTMPN epitopes, represents the average affinity, or avidity, of the antibodies for HTMPN. The K_a determined for a preparation of monoclonal antibodies, which are monospecific for a particular HTMPN epitope, represents a true measure of affinity. High-affinity antibody 15 preparations with K_a ranging from about 10^9 to 10^{12} L/mole are preferred for use in immunoassays in which the HTMPN-antibody complex must withstand rigorous manipulations. Low-affinity antibody preparations with K_a ranging from about 10^6 to 10^7 L/mole are preferred for use in immunopurification and similar procedures which ultimately require dissociation of HTMPN, preferably in active form, from the antibody 20 (Catty, D. (1988) Antibodies, Volume I: A Practical Approach, IRL Press, Washington, DC; Liddell, J. E. and Cryer, A. (1991) A Practical Guide to Monoclonal Antibodies, John Wiley & Sons, New York NY).

The titer and avidity of polyclonal antibody preparations may be further evaluated to determine the quality and suitability of such preparations for certain downstream 25 applications. For example, a polyclonal antibody preparation containing at least 1-2 mg specific antibody/ml, preferably 5-10 mg specific antibody/ml, is preferred for use in procedures requiring precipitation of HTMPN-antibody complexes. Procedures for evaluating antibody specificity, titer, and avidity, and guidelines for antibody quality and usage in various applications, are generally available. (See, e.g., Catty, supra, and Coligan 30 et al. supra.)

In another embodiment of the invention, the polynucleotides encoding HTMPN, or any fragment or complement thereof, may be used for therapeutic purposes. In one aspect,

the complement of the polynucleotide encoding HTMPN may be used in situations in which it would be desirable to block the transcription of the mRNA. In particular, cells may be transformed with sequences complementary to polynucleotides encoding HTMPN. Thus, complementary molecules or fragments may be used to modulate HTMPN activity, or to achieve regulation of gene function. Such technology is now well known in the art, and sense or antisense oligonucleotides or larger fragments can be designed from various locations along the coding or control regions of sequences encoding HTMPN.

Expression vectors derived from retroviruses, adenoviruses, or herpes or vaccinia viruses, or from various bacterial plasmids, may be used for delivery of nucleotide sequences to the targeted organ, tissue, or cell population. Methods which are well known to those skilled in the art can be used to construct vectors to express nucleic acid sequences complementary to the polynucleotides encoding HTMPN. (See, e.g., Sambrook, supra; Ausubel, 1995, supra.)

Genes encoding HTMPN can be turned off by transforming a cell or tissue with expression vectors which express high levels of a polynucleotide, or fragment thereof, encoding HTMPN. Such constructs may be used to introduce untranslatable sense or antisense sequences into a cell. Even in the absence of integration into the DNA, such vectors may continue to transcribe RNA molecules until they are disabled by endogenous nucleases. Transient expression may last for a month or more with a non-replicating vector, and may last even longer if appropriate replication elements are part of the vector system.

As mentioned above, modifications of gene expression can be obtained by designing complementary sequences or antisense molecules (DNA, RNA, or PNA) to the control, 5', or regulatory regions of the gene encoding HTMPN. Oligonucleotides derived from the transcription initiation site, e.g., between about positions -10 and +10 from the start site, are preferred. Similarly, inhibition can be achieved using triple helix base-pairing methodology. Triple helix pairing is useful because it causes inhibition of the ability of the double helix to open sufficiently for the binding of polymerases, transcription factors, or regulatory molecules. Recent therapeutic advances using triplex DNA have been described in the literature. (See, e.g., Gee, J.E. et al. (1994) in Huber, B.E. and B.I. Carr, Molecular and Immunologic Approaches, Futura Publishing, Mt. Kisco NY, pp. 163-177.) A complementary sequence or antisense molecule may also be designed to block

translation of mRNA by preventing the transcript from binding to ribosomes.

Ribozymes, enzymatic RNA molecules, may also be used to catalyze the specific cleavage of RNA. The mechanism of ribozyme action involves sequence-specific hybridization of the ribozyme molecule to complementary target RNA, followed by
5 endonucleolytic cleavage. For example, engineered hammerhead motif ribozyme molecules may specifically and efficiently catalyze endonucleolytic cleavage of sequences encoding HTMPN.

Specific ribozyme cleavage sites within any potential RNA target are initially identified by scanning the target molecule for ribozyme cleavage sites, including the
10 following sequences: GUA, GUU, and GUC. Once identified, short RNA sequences of between 15 and 20 ribonucleotides, corresponding to the region of the target gene containing the cleavage site, may be evaluated for secondary structural features which may render the oligonucleotide inoperable. The suitability of candidate targets may also be evaluated by testing accessibility to hybridization with complementary oligonucleotides
15 using ribonuclease protection assays.

Complementary ribonucleic acid molecules and ribozymes of the invention may be prepared by any method known in the art for the synthesis of nucleic acid molecules. These include techniques for chemically synthesizing oligonucleotides such as solid phase phosphoramidite chemical synthesis. Alternatively, RNA molecules may be generated by
20 in vitro and in vivo transcription of DNA sequences encoding HTMPN. Such DNA sequences may be incorporated into a wide variety of vectors with suitable RNA polymerase promoters such as T7 or SP6. Alternatively, these cDNA constructs that synthesize complementary RNA, constitutively or inducibly, can be introduced into cell lines, cells, or tissues.

25 RNA molecules may be modified to increase intracellular stability and half-life. Possible modifications include, but are not limited to, the addition of flanking sequences at the 5' and/or 3' ends of the molecule, or the use of phosphorothioate or 2' O-methyl rather than phosphodiesterase linkages within the backbone of the molecule. This concept is inherent in the production of PNAs and can be extended in all of these molecules by the
30 inclusion of nontraditional bases such as inosine, queosine, and wybutosine, as well as acetyl-, methyl-, thio-, and similarly modified forms of adenine, cytidine, guanine, thymine, and uridine which are not as easily recognized by endogenous endonucleases.

Many methods for introducing vectors into cells or tissues are available and equally suitable for use in vivo, in vitro, and ex vivo. For ex vivo therapy, vectors may be introduced into stem cells taken from the patient and clonally propagated for autologous transplant back into that same patient. Delivery by transfection, by liposome injections, or
5 by polycationic amino polymers may be achieved using methods which are well known in the art. (See, e.g., Goldman, C.K. et al. (1997) Nature Biotechnology 15:462-466.)

Any of the therapeutic methods described above may be applied to any subject in need of such therapy, including, for example, mammals such as dogs, cats, cows, horses, rabbits, monkeys, and most preferably, humans.

10 An additional embodiment of the invention relates to the administration of a pharmaceutical or sterile composition, in conjunction with a pharmaceutically acceptable carrier, for any of the therapeutic effects discussed above. Such pharmaceutical compositions may consist of HTMPN, antibodies to HTMPN, and mimetics, agonists, antagonists, or inhibitors of HTMPN. The compositions may be administered alone or in
15 combination with at least one other agent, such as a stabilizing compound, which may be administered in any sterile, biocompatible pharmaceutical carrier including, but not limited to, saline, buffered saline, dextrose, and water. The compositions may be administered to a patient alone, or in combination with other agents, drugs, or hormones.

The pharmaceutical compositions utilized in this invention may be administered by
20 any number of routes including, but not limited to, oral, intravenous, intramuscular, intra-arterial, intramedullary, intrathecal, intraventricular, transdermal, subcutaneous, intraperitoneal, intranasal, enteral, topical, sublingual, or rectal means.

In addition to the active ingredients, these pharmaceutical compositions may contain suitable pharmaceutically-acceptable carriers comprising excipients and auxiliaries
25 which facilitate processing of the active compounds into preparations which can be used pharmaceutically. Further details on techniques for formulation and administration may be found in the latest edition of Remington's Pharmaceutical Sciences (Maack Publishing, Easton PA).

Pharmaceutical compositions for oral administration can be formulated using
30 pharmaceutically acceptable carriers well known in the art in dosages suitable for oral administration. Such carriers enable the pharmaceutical compositions to be formulated as tablets, pills, dragees, capsules, liquids, gels, syrups, slurries, suspensions, and the like, for

ingestion by the patient.

Pharmaceutical preparations for oral use can be obtained through combining active compounds with solid excipient and processing the resultant mixture of granules (optionally, after grinding) to obtain tablets or dragee cores. Suitable auxiliaries can be added, if desired. Suitable excipients include carbohydrate or protein fillers, such as sugars, including lactose, sucrose, mannitol, and sorbitol; starch from corn, wheat, rice, potato, or other plants; cellulose, such as methyl cellulose, hydroxypropylmethyl-cellulose, or sodium carboxymethylcellulose; gums, including arabic and tragacanth; and proteins, such as gelatin and collagen. If desired, disintegrating or solubilizing agents may be added, such as the cross-linked polyvinyl pyrrolidone, agar, and alginic acid or a salt thereof, such as sodium alginate.

Dragee cores may be used in conjunction with suitable coatings, such as concentrated sugar solutions, which may also contain gum arabic, talc, polyvinylpyrrolidone, carbopol gel, polyethylene glycol, and/or titanium dioxide, lacquer solutions, and suitable organic solvents or solvent mixtures. Dyestuffs or pigments may be added to the tablets or dragee coatings for product identification or to characterize the quantity of active compound, i.e., dosage.

Pharmaceutical preparations which can be used orally include push-fit capsules made of gelatin, as well as soft, sealed capsules made of gelatin and a coating, such as glycerol or sorbitol. Push-fit capsules can contain active ingredients mixed with fillers or binders, such as lactose or starches, lubricants, such as talc or magnesium stearate, and, optionally, stabilizers. In soft capsules, the active compounds may be dissolved or suspended in suitable liquids, such as fatty oils, liquid, or liquid polyethylene glycol with or without stabilizers.

Pharmaceutical formulations suitable for parenteral administration may be formulated in aqueous solutions, preferably in physiologically compatible buffers such as Hanks' solution, Ringer's solution, or physiologically buffered saline. Aqueous injection suspensions may contain substances which increase the viscosity of the suspension, such as sodium carboxymethyl cellulose, sorbitol, or dextran. Additionally, suspensions of the active compounds may be prepared as appropriate oily injection suspensions. Suitable lipophilic solvents or vehicles include fatty oils, such as sesame oil, or synthetic fatty acid esters, such as ethyl oleate, triglycerides, or liposomes. Non-lipid polycationic amino

polymers may also be used for delivery. Optionally, the suspension may also contain suitable stabilizers or agents to increase the solubility of the compounds and allow for the preparation of highly concentrated solutions.

For topical or nasal administration, penetrants appropriate to the particular barrier
5 to be permeated are used in the formulation. Such penetrants are generally known in the art.

The pharmaceutical compositions of the present invention may be manufactured in a manner that is known in the art, e.g., by means of conventional mixing, dissolving, granulating, dragee-making, levigating, emulsifying, encapsulating, entrapping, or
10 lyophilizing processes.

The pharmaceutical composition may be provided as a salt and can be formed with many acids, including but not limited to, hydrochloric, sulfuric, acetic, lactic, tartaric, malic, and succinic acid. Salts tend to be more soluble in aqueous or other protonic solvents than are the corresponding free base forms. In other cases, the preferred
15 preparation may be a lyophilized powder which may contain any or all of the following: 1 mM to 50 mM histidine, 0.1% to 2% sucrose, and 2% to 7% mannitol, at a pH range of 4.5 to 5.5, that is combined with buffer prior to use.

After pharmaceutical compositions have been prepared, they can be placed in an appropriate container and labeled for treatment of an indicated condition. For
20 administration of HTMPN, such labeling would include amount, frequency, and method of administration.

Pharmaceutical compositions suitable for use in the invention include compositions wherein the active ingredients are contained in an effective amount to achieve the intended purpose. The determination of an effective dose is well within the capability of those
25 skilled in the art.

For any compound, the therapeutically effective dose can be estimated initially either in cell culture assays, e.g., of neoplastic cells or in animal models such as mice, rats, rabbits, dogs, or pigs. An animal model may also be used to determine the appropriate concentration range and route of administration. Such information can then be used to
30 determine useful doses and routes for administration in humans.

A therapeutically effective dose refers to that amount of active ingredient, for example HTMPN or fragments thereof, antibodies of HTMPN, and agonists, antagonists

or inhibitors of HTMPN, which ameliorates the symptoms or condition. Therapeutic efficacy and toxicity may be determined by standard pharmaceutical procedures in cell cultures or with experimental animals, such as by calculating the ED_{50} (the dose therapeutically effective in 50% of the population) or LD_{50} (the dose lethal to 50% of the population) statistics. The dose ratio of toxic to therapeutic effects is the therapeutic index, and it can be expressed as the LD_{50}/ED_{50} ratio. Pharmaceutical compositions which exhibit large therapeutic indices are preferred. The data obtained from cell culture assays and animal studies are used to formulate a range of dosage for human use. The dosage contained in such compositions is preferably within a range of circulating concentrations that includes the ED_{50} with little or no toxicity. The dosage varies within this range depending upon the dosage form employed, the sensitivity of the patient, and the route of administration.

The exact dosage will be determined by the practitioner, in light of factors related to the subject requiring treatment. Dosage and administration are adjusted to provide sufficient levels of the active moiety or to maintain the desired effect. Factors which may be taken into account include the severity of the disease state, the general health of the subject, the age, weight, and gender of the subject, time and frequency of administration, drug combination(s), reaction sensitivities, and response to therapy. Long-acting pharmaceutical compositions may be administered every 3 to 4 days, every week, or biweekly depending on the half-life and clearance rate of the particular formulation.

Normal dosage amounts may vary from about $0.1 \mu\text{g}$ to $100,000 \mu\text{g}$, up to a total dose of about 1 gram, depending upon the route of administration. Guidance as to particular dosages and methods of delivery is provided in the literature and generally available to practitioners in the art. Those skilled in the art will employ different formulations for nucleotides than for proteins or their inhibitors. Similarly, delivery of polynucleotides or polypeptides will be specific to particular cells, conditions, locations, etc.

DIAGNOSTICS

In another embodiment, antibodies which specifically bind HTMPN may be used for the diagnosis of disorders characterized by expression of HTMPN, or in assays to monitor patients being treated with HTMPN or agonists, antagonists, or inhibitors of HTMPN. Antibodies useful for diagnostic purposes may be prepared in the same manner

as described above for therapeutics. Diagnostic assays for HTMPN include methods which utilize the antibody and a label to detect HTMPN in human body fluids or in extracts of cells or tissues. The antibodies may be used with or without modification, and may be labeled by covalent or non-covalent attachment of a reporter molecule. A wide
5 variety of reporter molecules, several of which are described above, are known in the art and may be used.

A variety of protocols for measuring HTMPN, including ELISAs, RIAs, and FACS, are known in the art and provide a basis for diagnosing altered or abnormal levels of HTMPN expression. Normal or standard values for HTMPN expression are established
10 by combining body fluids or cell extracts taken from normal mammalian subjects, preferably human, with antibody to HTMPN under conditions suitable for complex formation. The amount of standard complex formation may be quantitated by various methods, preferably by photometric means. Quantities of HTMPN expressed in subject, control, and disease samples from biopsied tissues are compared with the standard values.
15 Deviation between standard and subject values establishes the parameters for diagnosing disease.

In another embodiment of the invention, the polynucleotides encoding HTMPN may be used for diagnostic purposes. The polynucleotides which may be used include oligonucleotide sequences, complementary RNA and DNA molecules, and PNAs. The
20 polynucleotides may be used to detect and quantitate gene expression in biopsied tissues in which expression of HTMPN may be correlated with disease. The diagnostic assay may be used to determine absence, presence, and excess expression of HTMPN, and to monitor regulation of HTMPN levels during therapeutic intervention.

In one aspect, hybridization with PCR probes which are capable of detecting
25 polynucleotide sequences, including genomic sequences, encoding HTMPN or closely related molecules may be used to identify nucleic acid sequences which encode HTMPN. The specificity of the probe, whether it is made from a highly specific region, e.g., the 5' regulatory region, or from a less specific region, e.g., a conserved motif, and the stringency of the hybridization or amplification (maximal, high, intermediate, or low), will determine
30 whether the probe identifies only naturally occurring sequences encoding HTMPN, allelic variants, or related sequences.

Probes may also be used for the detection of related sequences, and should

preferably have at least 50% sequence identity to any of the HTMPN encoding sequences. The hybridization probes of the subject invention may be DNA or RNA and may be derived from the sequence of SEQ ID NO:80-158 or from genomic sequences including promoters, enhancers, and introns of the HTMPN gene.

- 5 Means for producing specific hybridization probes for DNAs encoding HTMPN include the cloning of polynucleotide sequences encoding HTMPN or HTMPN derivatives into vectors for the production of mRNA probes. Such vectors are known in the art, are commercially available, and may be used to synthesize RNA probes in vitro by means of the addition of the appropriate RNA polymerases and the appropriate labeled nucleotides.
- 10 Hybridization probes may be labeled by a variety of reporter groups, for example, by radionuclides such as ^{32}P or ^{35}S , or by enzymatic labels, such as alkaline phosphatase coupled to the probe via avidin/biotin coupling systems, and the like.

- Polynucleotide sequences encoding HTMPN may be used for the diagnosis of disorders associated with expression of HTMPN. Examples of such disorders include, but
- 15 are not limited to, an immune disorder such as acquired immunodeficiency syndrome (AIDS), Addison's disease, adult respiratory distress syndrome, allergies, ankylosing spondylitis, amyloidosis, anemia, asthma, atherosclerosis, autoimmune hemolytic anemia, autoimmune thyroiditis, autoimmune polyendocrinopathy-candidiasis-ectodermal dystrophy (APECED), bronchitis, cholecystitis, contact dermatitis, Crohn's disease, atopic
- 20 dermatitis, dermatomyositis, diabetes mellitus, emphysema, episodic lymphopenia with lymphocytotoxins, erythroblastosis fetalis, erythema nodosum, atrophic gastritis, glomerulonephritis, Goodpasture's syndrome, gout, Graves' disease, Hashimoto's thyroiditis, hypereosinophilia, irritable bowel syndrome, multiple sclerosis, myasthenia gravis, myocardial or pericardial inflammation, osteoarthritis, osteoporosis, pancreatitis,
- 25 polymyositis, psoriasis, Reiter's syndrome, rheumatoid arthritis, scleroderma, Sjögren's syndrome, systemic anaphylaxis, systemic lupus erythematosus, systemic sclerosis, thrombocytopenic purpura, ulcerative colitis, uveitis, Werner syndrome, complications of cancer, hemodialysis, and extracorporeal circulation, viral, bacterial, fungal, parasitic, protozoal, and helminthic infections, and trauma; a reproductive disorder such as a
- 30 disorder of prolactin production; infertility, including tubal disease, ovulatory defects, and endometriosis; a disruption of the estrous cycle, a disruption of the menstrual cycle, polycystic ovary syndrome, ovarian hyperstimulation syndrome, endometrial and ovarian

tumors, uterine fibroids, autoimmune disorders, ectopic pregnancies, and teratogenesis; cancer of the breast, fibrocystic breast disease, and galactorrhea; disruptions of spermatogenesis, abnormal sperm physiology, cancer of the testis, cancer of the prostate, benign prostatic hyperplasia, prostatitis, Peyronie's disease, impotence, carcinoma of the male breast, and gynecomastia; a smooth muscle disorder such as angina, anaphylactic shock, arrhythmias, asthma, cardiovascular shock, Cushing's syndrome, hypertension, hypoglycemia, myocardial infarction, migraine, and pheochromocytoma, and myopathies including cardiomyopathy, encephalopathy, epilepsy, Kearns-Sayre syndrome, lactic acidosis, myoclonic disorder, and ophthalmoplegia; a neurological disorder such as epilepsy, ischemic cerebrovascular disease, stroke, cerebral neoplasms, Alzheimer's disease, Pick's disease, Huntington's disease, dementia, Parkinson's disease and other extrapyramidal disorders, amyotrophic lateral sclerosis and other motor neuron disorders, progressive neural muscular atrophy, retinitis pigmentosa, hereditary ataxias, multiple sclerosis and other demyelinating diseases, bacterial and viral meningitis, brain abscess, subdural empyema, epidural abscess, suppurative intracranial thrombophlebitis, myelitis and radiculitis, viral central nervous system disease; prion diseases including kuru, Creutzfeldt-Jakob disease, and Gerstmann-Straussler-Scheinker syndrome; fatal familial insomnia, nutritional and metabolic diseases of the nervous system, neurofibromatosis, tuberous sclerosis, cerebelloretinal hemangioblastomatosis, encephalotrigeminal syndrome, mental retardation and other developmental disorders of the central nervous system, cerebral palsy, neuroskeletal disorders, autonomic nervous system disorders, cranial nerve disorders, spinal cord diseases, muscular dystrophy and other neuromuscular disorders, peripheral nervous system disorders, dermatomyositis and polymyositis; inherited, metabolic, endocrine, and toxic myopathies; myasthenia gravis, periodic paralysis; mental disorders including mood, anxiety, and schizophrenic disorders; akathisia, amnesia, catatonia, diabetic neuropathy, tardive dyskinesia, dystonias, paranoid psychoses, postherpetic neuralgia, and Tourette's disorder; a gastrointestinal disorder such as dysphagia, peptic esophagitis, esophageal spasm, esophageal stricture, esophageal carcinoma, dyspepsia, indigestion, gastritis, gastric carcinoma, anorexia, nausea, emesis, gastroparesis, antral or pyloric edema, abdominal angina, pyrosis, gastroenteritis, intestinal obstruction, infections of the intestinal tract, peptic ulcer, cholelithiasis, cholecystitis, cholestasis, pancreatitis, pancreatic carcinoma, biliary tract disease, hepatoma, infectious

- colitis, ulcerative colitis, ulcerative proctitis, Crohn's disease, Whipple's disease, Mallory-Weiss syndrome, colonic carcinoma, colonic obstruction, irritable bowel syndrome, short bowel syndrome, diarrhea, constipation, gastrointestinal hemorrhage, and acquired immunodeficiency syndrome (AIDS) enteropathy, cirrhosis, jaundice, cholestasis,
- 5 hereditary hyperbilirubinemia, hepatic encephalopathy, hepatorenal syndrome, hepatitis, hepatic steatosis, hemochromatosis, Wilson's disease, α_1 -antitrypsin deficiency, Reye's syndrome, primary sclerosing cholangitis, liver infarction, portal vein obstruction and thrombosis, passive congestion, centrilobular necrosis, peliosis hepatis, hepatic vein thrombosis, veno-occlusive disease, preeclampsia, eclampsia, acute fatty liver of
- 10 pregnancy, intrahepatic cholestasis of pregnancy, and hepatic tumors including nodular hyperplasias, adenomas, and carcinomas; a cell proliferative disorder such as actinic keratosis, arteriosclerosis, atherosclerosis, bursitis, cirrhosis, hepatitis, mixed connective tissue disease (MCTD), myelofibrosis, paroxysmal nocturnal hemoglobinuria, polycythemia vera, psoriasis, primary thrombocythemia, and cancers including
- 15 adenocarcinoma, leukemia, lymphoma, melanoma, myeloma, sarcoma, teratocarcinoma, and, in particular, cancers of the adrenal gland, bladder, bone, bone marrow, brain, breast, cervix, gall bladder, ganglia, gastrointestinal tract, heart, kidney, liver, lung, muscle, ovary, pancreas, parathyroid, penis, prostate, salivary glands, skin, spleen, testis, thymus, thyroid, and uterus; and a developmental disorder including, but not limited to, those listed above.
- 20 The polynucleotide sequences encoding HTMPN may be used in Southern or northern analysis, dot blot, or other membrane-based technologies; in PCR technologies; in dipstick, pin, and multiformat ELISA-like assays; and in microarrays utilizing fluids or tissues from patients to detect altered HTMPN expression. Such qualitative or quantitative methods are well known in the art.
- 25 In a particular aspect, the nucleotide sequences encoding HTMPN may be useful in assays that detect the presence of associated disorders, particularly those mentioned above. The nucleotide sequences encoding HTMPN may be labeled by standard methods and added to a fluid or tissue sample from a patient under conditions suitable for the formation of hybridization complexes. After a suitable incubation period, the sample is washed and
- 30 the signal is quantitated and compared with a standard value. If the amount of signal in the patient sample is significantly altered in comparison to a control sample then the presence of altered levels of nucleotide sequences encoding HTMPN in the sample indicates the

presence of the associated disorder. Such assays may also be used to evaluate the efficacy of a particular therapeutic treatment regimen in animal studies, in clinical trials, or to monitor the treatment of an individual patient.

In order to provide a basis for the diagnosis of a disorder associated with expression of HTMPN, a normal or standard profile for expression is established. This may be accomplished by combining body fluids or cell extracts taken from normal subjects, either animal or human, with a sequence, or a fragment thereof, encoding HTMPN, under conditions suitable for hybridization or amplification. Standard hybridization may be quantified by comparing the values obtained from normal subjects with values from an experiment in which a known amount of a substantially purified polynucleotide is used. Standard values obtained in this manner may be compared with values obtained from samples from patients who are symptomatic for a disorder. Deviation from standard values is used to establish the presence of a disorder.

Once the presence of a disorder is established and a treatment protocol is initiated, hybridization assays may be repeated on a regular basis to determine if the level of expression in the patient begins to approximate that which is observed in the normal subject. The results obtained from successive assays may be used to show the efficacy of treatment over a period ranging from several days to months.

With respect to cancer, the presence of an abnormal amount of transcript (either under- or overexpressed) in biopsied tissue from an individual may indicate a predisposition for the development of the disease, or may provide a means for detecting the disease prior to the appearance of actual clinical symptoms. A more definitive diagnosis of this type may allow health professionals to employ preventative measures or aggressive treatment earlier thereby preventing the development or further progression of the cancer.

Additional diagnostic uses for oligonucleotides designed from the sequences encoding HTMPN may involve the use of PCR. These oligomers may be chemically synthesized, generated enzymatically, or produced in vitro. Oligomers will preferably contain a fragment of a polynucleotide encoding HTMPN, or a fragment of a polynucleotide complementary to the polynucleotide encoding HTMPN, and will be employed under optimized conditions for identification of a specific gene or condition. Oligomers may also be employed under less stringent conditions for detection or

quantitation of closely related DNA or RNA sequences.

Methods which may also be used to quantitate the expression of HTMPN include radiolabeling or biotinylating nucleotides, coamplification of a control nucleic acid, and interpolating results from standard curves. (See, e.g., Melby, P.C. et al. (1993) J.

5 Immunol. Methods 159:235-244; Duplaa, C. et al. (1993) Anal. Biochem. 212:229-236.)

The speed of quantitation of multiple samples may be accelerated by running the assay in an ELISA format where the oligomer of interest is presented in various dilutions and a spectrophotometric or colorimetric response gives rapid quantitation.

In further embodiments, oligonucleotides or longer fragments derived from any of
10 the polynucleotide sequences described herein may be used as targets in a microarray. The microarray can be used to monitor the expression level of large numbers of genes simultaneously and to identify genetic variants, mutations, and polymorphisms. This information may be used to determine gene function, to understand the genetic basis of a disorder, to diagnose a disorder, and to develop and monitor the activities of therapeutic
15 agents.

Microarrays may be prepared, used, and analyzed using methods known in the art. (See, e.g., Brennan, T.M. et al. (1995) U.S. Patent No. 5,474,796; Schena, M. et al. (1996) Proc. Natl. Acad. Sci. 93:10614-10619; Baldeschweiler et al. (1995) PCT application WO95/251116; Shalon, D. et al. (1995) PCT application WO95/35505; Heller, R.A. et al.
20 (1997) Proc. Natl. Acad. Sci. 94:2150-2155; and Heller, M.J. et al. (1997) U.S. Patent No. 5,605,662.)

In another embodiment of the invention, nucleic acid sequences encoding HTMPN may be used to generate hybridization probes useful in mapping the naturally occurring genomic sequence. The sequences may be mapped to a particular chromosome, to a
25 specific region of a chromosome, or to artificial chromosome constructions, e.g., human artificial chromosomes (HACs), yeast artificial chromosomes (YACs), bacterial artificial chromosomes (BACs), bacterial P1 constructions, or single chromosome cDNA libraries. (See, e.g., Harrington, J.J. et al. (1997) Nat Genet. 15:345-355; Price, C.M. (1993) Blood Rev. 7:127-134; and Trask, B.J. (1991) Trends Genet. 7:149-154.)

30 Fluorescent in situ hybridization (FISH) may be correlated with other physical chromosome mapping techniques and genetic map data. (See, e.g., Heinz-Ulrich, et al. (1995) in Meyers, supra, pp. 965-968.) Examples of genetic map data can be found in

various scientific journals or at the Online Mendelian Inheritance in Man (OMIM) site. Correlation between the location of the gene encoding HTMPN on a physical chromosomal map and a specific disorder, or a predisposition to a specific disorder, may help define the region of DNA associated with that disorder. The nucleotide sequences of the invention may be used to detect differences in gene sequences among normal, carrier, and affected individuals.

In situ hybridization of chromosomal preparations and physical mapping techniques, such as linkage analysis using established chromosomal markers, may be used for extending genetic maps. Often the placement of a gene on the chromosome of another mammalian species, such as mouse, may reveal associated markers even if the number or arm of a particular human chromosome is not known. New sequences can be assigned to chromosomal arms by physical mapping. This provides valuable information to investigators searching for disease genes using positional cloning or other gene discovery techniques. Once the disease or syndrome has been crudely localized by genetic linkage to a particular genomic region, e.g., ataxia-telangiectasia to 11q22-23, any sequences mapping to that area may represent associated or regulatory genes for further investigation. (See, e.g., Gatti, R.A. et al. (1988) Nature 336:577-580.) The nucleotide sequence of the subject invention may also be used to detect differences in the chromosomal location due to translocation, inversion, etc., among normal, carrier, or affected individuals.

In another embodiment of the invention, HTMPN, its catalytic or immunogenic fragments, or oligopeptides thereof can be used for screening libraries of compounds in any of a variety of drug screening techniques. The fragment employed in such screening may be free in solution, affixed to a solid support, borne on a cell surface, or located intracellularly. The formation of binding complexes between HTMPN and the agent being tested may be measured.

Another technique for drug screening provides for high throughput screening of compounds having suitable binding affinity to the protein of interest. (See, e.g., Geysen, et al. (1984) PCT application WO84/03564.) In this method, large numbers of different small test compounds are synthesized on a solid substrate. The test compounds are reacted with HTMPN, or fragments thereof, and washed. Bound HTMPN is then detected by methods well known in the art. Purified HTMPN can also be coated directly onto plates for use in the aforementioned drug screening techniques. Alternatively, non-neutralizing

antibodies can be used to capture the peptide and immobilize it on a solid support.

In another embodiment, one may use competitive drug screening assays in which neutralizing antibodies capable of binding HTMPN specifically compete with a test compound for binding HTMPN. In this manner, antibodies can be used to detect the
5 presence of any peptide which shares one or more antigenic determinants with HTMPN.

In additional embodiments, the nucleotide sequences which encode HTMPN may be used in any molecular biology techniques that have yet to be developed, provided the new techniques rely on properties of nucleotide sequences that are currently known, including, but not limited to, such properties as the triplet genetic code and specific base
10 pair interactions.

Without further elaboration, it is believed that one skilled in the art can, using the preceding description, utilize the present invention to its fullest extent. The following preferred specific embodiments are, therefore, to be construed as merely illustrative, and not limitative of the remainder of the disclosure in any way whatsoever.

15 The entire disclosure of all applications, patents, and publications, cited above and below, and of US provisional applications 60/087,260 (filed May 29, 1998), 60/091,674 (filed July 2, 1998), 60/102,954 (filed October 2, 1998), and 60/109,869 (filed November 24, 1998) is hereby incorporated by reference.

EXAMPLES

20 I. Construction of cDNA Libraries

RNA was purchased from Clontech or isolated from tissues described in Table 4. Some tissues were homogenized and lysed in guanidinium isothiocyanate, while others were homogenized and lysed in phenol or in a suitable mixture of denaturants, such as TRIZOL (Life Technologies), a monophasic solution of phenol and guanidine
25 isothiocyanate. The resulting lysates were centrifuged over CsCl cushions or extracted with chloroform. RNA was precipitated from the lysates with either isopropanol or sodium acetate and ethanol, or by other routine methods.

Phenol extraction and precipitation of RNA were repeated as necessary to increase RNA purity. In some cases, RNA was treated with DNase. For most libraries, poly(A+) RNA was isolated using oligo d(T)-coupled paramagnetic particles (Promega),
30 OLIGOTEX latex particles (QIAGEN, Valencia CA), or an OLIGOTEX mRNA purification kit (QIAGEN). Alternatively, RNA was isolated directly from tissue lysates

using other RNA isolation kits, e.g., the POLY(A)PURE mRNA purification kit (Ambion, Austin TX).

In some cases, Stratagene was provided with RNA and constructed the corresponding cDNA libraries. Otherwise, cDNA was synthesized and cDNA libraries were constructed with the UNIZAP vector system (Stratagene) or SUPERScript plasmid system (Life Technologies), using the recommended procedures or similar methods known in the art. (See, e.g., Ausubel, 1997, supra, units 5.1-6.6). Reverse transcription was initiated using oligo d(T) or random primers. Synthetic oligonucleotide adapters were ligated to double stranded cDNA, and the cDNA was digested with the appropriate restriction enzyme or enzymes. For most libraries, the cDNA was size-selected (300-1000 bp) using SEPHACRYL S1000, SEPHAROSE CL2B, or SEPHAROSE CL4B column chromatography (Amersham Pharmacia Biotech) or preparative agarose gel electrophoresis. cDNAs were ligated into compatible restriction enzyme sites of the polylinker of a suitable plasmid, e.g., PBLUESCRIPT plasmid (Stratagene), pSPORT1 plasmid (Life Technologies), or pINCY (Incyte Pharmaceuticals, Palo Alto CA). Recombinant plasmids were transformed into competent *E. coli* cells including XL1-Blue, XL1-BlueMRF, or SOLR from Stratagene or DH5 α , DH10B, or ElectroMAX DH10B from Life Technologies.

II. Isolation of cDNA Clones

Plasmids were recovered from host cells by in vivo excision, using the UNIZAP vector system (Stratagene) or cell lysis. Plasmids were purified using at least one of the following: a Magic or WIZARD Minipreps DNA purification system (Promega); an AGTC Miniprep purification kit (Edge Biosystems, Gaithersburg MD); and QIAWELL 8 Plasmid, QIAWELL 8 Plus Plasmid, QIAWELL 8 Ultra Plasmid purification systems or the REAL Prep 96 plasmid kit from QIAGEN. Following precipitation, plasmids were resuspended in 0.1 ml of distilled water and stored, with or without lyophilization, at 4°C.

Alternatively, plasmid DNA was amplified from host cell lysates using direct link PCR in a high-throughput format (Rao, V.B. (1994) Anal. Biochem. 216:1-14). Host cell lysis and thermal cycling steps were carried out in a single reaction mixture. Samples were processed and stored in 384-well plates, and the concentration of amplified plasmid DNA was quantified fluorometrically using PICOGREEN dye (Molecular Probes, Eugene OR) and a Fluoroskan II fluorescence scanner (Labsystems Oy, Helsinki, Finland).

III. Sequencing and Analysis

The cDNAs were prepared for sequencing using the ABI CATALYST 800 (Perkin-Elmer) or the HYDRA microdispenser (Robbins Scientific) or MICROLAB 2200 (Hamilton) systems in combination with the PTC-200 thermal cyclers (MJ Research). The cDNAs were sequenced using the ABI PRISM 373 or 377 sequencing systems (Perkin-Elmer) and standard ABI protocols, base calling software, and kits. In one alternative, cDNAs were sequenced using the MEGABACE 1000 DNA sequencing system (Molecular Dynamics). In another alternative, the cDNAs were amplified and sequenced using the ABI PRISM BIGDYE Terminator cycle sequencing ready reaction kit (Perkin-Elmer). In yet another alternative, cDNAs were sequenced using solutions and dyes from Amersham Pharmacia Biotech. Reading frames for the ESTs were determined using standard methods (reviewed in Ausubel, 1997, supra, unit 7.7). Some of the cDNA sequences were selected for extension using the techniques disclosed in Example V.

The polynucleotide sequences derived from cDNA, extension, and shotgun sequencing were assembled and analyzed using a combination of software programs which utilize algorithms well known to those skilled in the art. Table 5 summarizes the software programs, descriptions, references, and threshold parameters used. The first column of Table 5 shows the tools, programs, and algorithms used, the second column provides a brief description thereof, the third column presents the references which are incorporated by reference herein, and the fourth column presents, where applicable, the scores, probability values, and other parameters used to evaluate the strength of a match between two sequences (the higher the probability the greater the homology). Sequences were analyzed using MACDNASIS PRO software (Hitachi Software Engineering, South San Francisco CA) and LASERGENE software (DNASTAR).

The polynucleotide sequences were validated by removing vector, linker, and polyA sequences and by masking ambiguous bases, using algorithms and programs based on BLAST, dynamic programming, and dinucleotide nearest neighbor analysis. The sequences were then queried against a selection of public databases such as GenBank primate, rodent, mammalian, vertebrate, and eukaryote databases, and BLOCKS to acquire annotation, using programs based on BLAST, FASTA, and BLIMPS. The sequences were assembled into full length polynucleotide sequences using programs based on Phred, Phrap, and Consed, and were screened for open reading frames using programs based on

GeneMark, BLAST, and FASTA. The full length polynucleotide sequences were translated to derive the corresponding full length amino acid sequences, and these full length sequences were subsequently analyzed by querying against databases such as the GenBank databases (described above), SwissProt, BLOCKS, PRINTS, Prosite, and

5 Hidden Markov Model (HMM)-based protein family databases such as PFAM. HMM is a probabilistic approach which analyzes consensus primary structures of gene families. (See, e.g., Eddy, S.R. (1996) *Cur. Opin. Str. Biol.* 6:361-365.)

The programs described above for the assembly and analysis of full length polynucleotide and amino acid sequences were also used to identify polynucleotide

10 sequence fragments from SEQ ID NO:80-158. Fragments from about 20 to about 4000 nucleotides which are useful in hybridization and amplification technologies were described in The Invention section above.

IV. Northern Analysis

Northern analysis is a laboratory technique used to detect the presence of a

15 transcript of a gene and involves the hybridization of a labeled nucleotide sequence to a membrane on which RNAs from a particular cell type or tissue have been bound. (See, e.g., Sambrook, *supra*, ch. 7; Ausubel, 1995, *supra*, ch. 4 and 16.)

Analogous computer techniques applying BLAST were used to search for identical or related molecules in nucleotide databases such as GenBank or LIFESEQ database

20 (Incyte Pharmaceuticals). This analysis is much faster than multiple membrane-based hybridizations. In addition, the sensitivity of the computer search can be modified to determine whether any particular match is categorized as exact or similar. The basis of the search is the product score, which is defined as:

$$\frac{\% \text{ sequence identity} \times \% \text{ maximum BLAST score}}{100}$$

25

100

The product score takes into account both the degree of similarity between two sequences and the length of the sequence match. For example, with a product score of 40, the match will be exact within a 1% to 2% error, and, with a product score of 70, the match will be exact. Similar molecules are usually identified by selecting those which show product

30 scores between 15 and 40, although lower scores may identify related molecules.

The results of northern analyses are reported as a percentage distribution of libraries in which the transcript encoding HTMPN occurred. Analysis involved the

categorization of cDNA libraries by organ/tissue and disease. The organ/tissue categories included cardiovascular, dermatologic, developmental, endocrine, gastrointestinal, hematopoietic/immune, musculoskeletal, nervous, reproductive, and urologic. The disease/condition categories included cancer, inflammation/trauma, cell proliferation, neurological, and pooled. For each category, the number of libraries expressing the sequence of interest was counted and divided by the total number of libraries across all categories. Percentage values of tissue-specific and disease- or condition-specific expression are reported in Table 3.

V. Extension of HTMPN Encoding Polynucleotides

Full length nucleic acid sequences of SEQ ID NOs:80-120 were produced by extension of the component fragments described in Table 1, column 5, using oligonucleotide primers based on these fragments. For each nucleic acid sequence, one primer was synthesized to initiate extension of an antisense polynucleotide, and the other was synthesized to initiate extension of a sense polynucleotide. Primers were used to facilitate the extension of the known sequence "outward" generating amplicons containing new unknown nucleotide sequence for the region of interest. The initial primers were designed from the cDNA using OLIGO™ 4.06 (National Biosciences, Plymouth, MN), or another appropriate program, to be about 22 to 30 nucleotides in length, to have a GC content of about 50% or more, and to anneal to the target sequence at temperatures of about 68°C to about 72°C. Any stretch of nucleotides which would result in hairpin structures and primer-primer dimerizations was avoided.

Selected human cDNA libraries (GIBCO BRL) were used to extend the sequence. If more than one extension is necessary or desired, additional sets of primers are designed to further extend the known region.

High fidelity amplification was obtained by following the instructions for the XL-PCR™ kit (The Perkin-Elmer Corp., Norwalk, CT) and thoroughly mixing the enzyme and reaction mix. PCR was performed using the PTC-200 thermal cycler (MJ Research, Inc., Watertown, MA), beginning with 40 pmol of each primer and the recommended concentrations of all other components of the kit, with the following parameters:

| | |
|--------|--|
| Step 1 | 94° C for 1 min (initial denaturation) |
| Step 2 | 65° C for 1 min |
| Step 3 | 68° C for 6 min |
| Step 4 | 94° C for 15 sec |

- Step 5 65° C for 1 min
 Step 6 68° C for 7 min
 Step 7 Repeat steps 4 through 6 for an additional 15 cycles
 Step 8 94° C for 15 sec
 5 Step 9 65° C for 1 min
 Step 10 68° C for 7:15 min
 Step 11 Repeat steps 8 through 10 for an additional 12 cycles
 Step 12 72° C for 8 min
 10 Step 13 4° C (and holding)

A 5 μ l to 10 μ l aliquot of the reaction mixture was analyzed by electrophoresis on a low concentration (about 0.6% to 0.8%) agarose mini-gel to determine which reactions were successful in extending the sequence. Bands thought to contain the largest products were excised from the gel, purified using QIAQUICK™ (QIAGEN Inc.), and trimmed of
 15 overhangs using Klenow enzyme to facilitate religation and cloning.

After ethanol precipitation, the products were redissolved in 13 μ l of ligation buffer, 1 μ l T4-DNA ligase (15 units) and 1 μ l T4 polynucleotide kinase were added, and the mixture was incubated at room temperature for 2 to 3 hours, or overnight at 16° C. Competent *E. coli* cells (in 40 μ l of appropriate media) were transformed with 3 μ l of
 20 ligation mixture and cultured in 80 μ l of SOC medium. (See, e.g., Sambrook, supra, Appendix A, p. 2.) After incubation for one hour at 37° C, the *E. coli* mixture was plated on Luria Bertani (LB) agar (See, e.g., Sambrook, supra, Appendix A, p. 1) containing carbenicillin (2x carb). The following day, several colonies were randomly picked from each plate and cultured in 150 μ l of liquid LB/2x carb medium placed in an individual well
 25 of an appropriate commercially-available sterile 96-well microtiter plate. The following day, 5 μ l of each overnight culture was transferred into a non-sterile 96-well plate and, after dilution 1:10 with water, 5 μ l from each sample was transferred into a PCR array.

For PCR amplification, 18 μ l of concentrated PCR reaction mix (3.3x) containing 4 units of rTth DNA polymerase, a vector primer, and one or both of the gene specific
 30 primers used for the extension reaction were added to each well. Amplification was performed using the following conditions:

- Step 1 94° C for 60 sec
 Step 2 94° C for 20 sec
 Step 3 55° C for 30 sec
 35 Step 4 72° C for 90 sec
 Step 5 Repeat steps 2 through 4 for an additional 29 cycles
 Step 6 72° C for 180 sec

Step 7 4° C (and holding)

Aliquots of the PCR reactions were run on agarose gels together with molecular weight markers. The sizes of the PCR products were compared to the original partial cDNAs, and appropriate clones were selected, ligated into plasmid, and sequenced.

The full length nucleic acid sequences of SEQ ID NO:121-158 were produced by extension of an appropriate fragment of the full length molecule using oligonucleotide primers designed from this fragment. One primer was synthesized to initiate 5' extension of the known fragment, and the other primer, to initiate 3' extension of the known fragment. The initial primers were designed using OLIGO 4.06 software (National Biosciences). or another appropriate program, to be about 22 to 30 nucleotides in length, to have a GC content of about 50% or more, and to anneal to the target sequence at temperatures of about 68°C to about 72°C. Any stretch of nucleotides which would result in hairpin structures and primer-primer dimerizations was avoided.

Selected human cDNA libraries were used to extend the sequence. If more than one extension was necessary or desired, additional or nested sets of primers were designed.

High fidelity amplification was obtained by PCR using methods well known in the art. PCR was performed in 96-well plates using the PTC-200 thermal cycler (MJ Research, Inc.). The reaction mix contained DNA template, 200 nmol of each primer, reaction buffer containing Mg^{2+} , $(NH_4)_2SO_4$, and β -mercaptoethanol, Taq DNA polymerase (Amersham Pharmacia Biotech), ELONGASE enzyme (Life Technologies), and Pfu DNA polymerase (Stratagene), with the following parameters for primer pair PCI A and PCI B: Step 1: 94°C, 3 min; Step 2: 94°C, 15 sec; Step 3: 60°C, 1 min; Step 4: 68°C, 2 min; Step 5: Steps 2, 3, and 4 repeated 20 times; Step 6: 68°C, 5 min; Step 7: storage at 4°C. In the alternative, the parameters for primer pair T7 and SK+ were as follows: Step 1: 94°C, 3 min; Step 2: 94°C, 15 sec; Step 3: 57°C, 1 min; Step 4: 68°C, 2 min; Step 5: Steps 2, 3, and 4 repeated 20 times; Step 6: 68°C, 5 min; Step 7: storage at 4°C.

The concentration of DNA in each well was determined by dispensing 100 μ l PICOGREEN quantitation reagent (0.25% (v/v) PICOGREEN; Molecular Probes, Eugene OR) dissolved in 1X TE and 0.5 μ l of undiluted PCR product into each well of an opaque fluorimeter plate (Corning Costar, Acton MA), allowing the DNA to bind to the reagent. The plate was scanned in a Fluoroskan II (Labsystems Oy, Helsinki, Finland) to measure

the fluorescence of the sample and to quantify the concentration of DNA. A 5 μ l to 10 μ l aliquot of the reaction mixture was analyzed by electrophoresis on a 1 % agarose mini-gel to determine which reactions were successful in extending the sequence.

The extended nucleotides were desalted and concentrated, transferred to 384-well plates, digested with CviJI cholera virus endonuclease (Molecular Biology Research, Madison WI), and sonicated or sheared prior to religation into pUC 18 vector (Amersham Pharmacia Biotech). For shotgun sequencing, the digested nucleotides were separated on low concentration (0.6 to 0.8%) agarose gels, fragments were excised, and agar digested with Agar ACE (Promega). Extended clones were religated using T4 ligase (New England Biolabs, Beverly MA) into pUC 18 vector (Amersham Pharmacia Biotech), treated with Pfu DNA polymerase (Stratagene) to fill-in restriction site overhangs, and transfected into competent *E. coli* cells. Transformed cells were selected on antibiotic-containing media, individual colonies were picked and cultured overnight at 37°C in 384-well plates in LB/2x carb liquid media.

The cells were lysed, and DNA was amplified by PCR using Taq DNA polymerase (Amersham Pharmacia Biotech) and Pfu DNA polymerase (Stratagene) with the following parameters: Step 1: 94°C, 3 min; Step 2: 94°C, 15 sec; Step 3: 60°C, 1 min; Step 4: 72°C, 2 min; Step 5: steps 2, 3, and 4 repeated 29 times; Step 6: 72°C, 5 min; Step 7: storage at 4°C. DNA was quantified by PICOGREEN reagent (Molecular Probes) as described above. Samples with low DNA recoveries were reamplified using the same conditions as described above. Samples were diluted with 20% dimethylsulphoxide (1:2, v/v), and sequenced using DYENAMIC energy transfer sequencing primers and the DYENAMIC DIRECT kit (Amersham Pharmacia Biotech) or the ABI PRISM BIGDYE Terminator cycle sequencing ready reaction kit (Perkin-Elmer).

In like manner, the nucleotide sequences of SEQ ID NO:80-158 are used to obtain 5' regulatory sequences using the procedure above, oligonucleotides designed for such extension, and an appropriate genomic library.

VI. Labeling and Use of Individual Hybridization Probes

Hybridization probes derived from SEQ ID NO:80-158 are employed to screen cDNAs, genomic DNAs, or mRNAs. Although the labeling of oligonucleotides, consisting of about 20 base pairs, is specifically described, essentially the same procedure is used with larger nucleotide fragments. Oligonucleotides are designed using state-of-the-

art software such as OLIGO 4.06 software (National Biosciences) and labeled by combining 50 pmol of each oligomer, 250 μ Ci of [γ - 32 P] adenosine triphosphate (Amersham Pharmacia Biotech), and T4 polynucleotide kinase (DuPont NEN, Boston MA). The labeled oligonucleotides are substantially purified using a SEPHADEX G-25
5 superfine size exclusion dextran bead column (Amersham Pharmacia Biotech). An aliquot containing 10^7 counts per minute of the labeled probe is used in a typical membrane-based hybridization analysis of human genomic DNA digested with one of the following endonucleases: Ase I, Bgl II, Eco RI, Pst I, Xba I, or Pvu II (DuPont NEN).

The DNA from each digest is fractionated on a 0.7% agarose gel and transferred to
10 nylon membranes (Nytran Plus, Schleicher & Schuell, Durham NH). Hybridization is carried out for 16 hours at 40°C. To remove nonspecific signals, blots are sequentially washed at room temperature under increasingly stringent conditions up to 0.1 x saline sodium citrate and 0.5% sodium dodecyl sulfate. After XOMAT-AR film (Eastman Kodak, Rochester NY) is exposed to the blots to film for several hours, hybridization
15 patterns are compared visually.

VII. Microarrays

A chemical coupling procedure and an ink jet device can be used to synthesize array elements on the surface of a substrate. (See, e.g., Baldeschweiler, supra.) An array analogous to a dot or slot blot may also be used to arrange and link elements to the surface
20 of a substrate using thermal, UV, chemical, or mechanical bonding procedures. A typical array may be produced by hand or using available methods and machines and contain any appropriate number of elements. After hybridization, nonhybridized probes are removed and a scanner used to determine the levels and patterns of fluorescence. The degree of complementarity and the relative abundance of each probe which hybridizes to an element
25 on the microarray may be assessed through analysis of the scanned images.

Full-length cDNAs, Expressed Sequence Tags (ESTs), or fragments thereof may comprise the elements of the microarray. Fragments suitable for hybridization can be selected using software well known in the art such as LASERGENE software (DNASTAR). Full-length cDNAs, ESTs, or fragments thereof corresponding to one of the
30 nucleotide sequences of the present invention, or selected at random from a cDNA library relevant to the present invention, are arranged on an appropriate substrate, e.g., a glass slide. The cDNA is fixed to the slide using, e.g., UV cross-linking followed by thermal

and chemical treatments and subsequent drying. (See, e.g., Schena, M. et al. (1995) Science 270:467-470; Shalon, D. et al. (1996) Genome Res. 6:639-645.) Fluorescent probes are prepared and used for hybridization to the elements on the substrate. The substrate is analyzed by procedures described above.

5 VIII. Complementary Polynucleotides

Sequences complementary to the HTMPN-encoding sequences, or any parts thereof, are used to detect, decrease, or inhibit expression of naturally occurring HTMPN. Although use of oligonucleotides comprising from about 15 to 30 base pairs is described, essentially the same procedure is used with smaller or with larger sequence fragments.

- 10 Appropriate oligonucleotides are designed using OLIGO 4.06 software (National Biosciences) and the coding sequence of HTMPN. To inhibit transcription, a complementary oligonucleotide is designed from the most unique 5' sequence and used to prevent promoter binding to the coding sequence. To inhibit translation, a complementary oligonucleotide is designed to prevent ribosomal binding to the HTMPN-encoding
- 15 transcript.

IX. Expression of HTMPN

- Expression and purification of HTMPN is achieved using bacterial or virus-based expression systems. For expression of HTMPN in bacteria, cDNA is subcloned into an appropriate vector containing an antibiotic resistance gene and an inducible promoter that
- 20 directs high levels of cDNA transcription. Examples of such promoters include, but are not limited to, the *trp-lac* (*tac*) hybrid promoter and the T5 or T7 bacteriophage promoter in conjunction with the *lac* operator regulatory element. Recombinant vectors are transformed into suitable bacterial hosts, e.g., BL21(DE3). Antibiotic resistant bacteria express HTMPN upon induction with isopropyl beta-D-thiogalactopyranoside (IPTG).
- 25 Expression of HTMPN in eukaryotic cells is achieved by infecting insect or mammalian cell lines with recombinant Autographica californica nuclear polyhedrosis virus (AcMNPV), commonly known as baculovirus. The nonessential polyhedrin gene of baculovirus is replaced with cDNA encoding HTMPN by either homologous recombination or bacterial-mediated transposition involving transfer plasmid
- 30 intermediates. Viral infectivity is maintained and the strong polyhedrin promoter drives high levels of cDNA transcription. Recombinant baculovirus is used to infect Spodoptera frugiperda (Sf9) insect cells in most cases, or human hepatocytes, in some cases. Infection

of the latter requires additional genetic modifications to baculovirus. (See Engelhard, E. K. et al. (1994) Proc. Natl. Acad. Sci. USA 91:3224-3227; Sandig, V. et al. (1996) Hum. Gene Ther. 7:1937-1945.)

In most expression systems, HTMPN is synthesized as a fusion protein with, e.g.,
5 glutathione S-transferase (GST) or a peptide epitope tag, such as FLAG or 6-His,
permitting rapid, single-step, affinity-based purification of recombinant fusion protein
from crude cell lysates. GST, a 26-kilodalton enzyme from Schistosoma japonicum,
enables the purification of fusion proteins on immobilized glutathione under conditions
that maintain protein activity and antigenicity (Amersham Pharmacia Biotech). Following
10 purification, the GST moiety can be proteolytically cleaved from HTMPN at specifically
engineered sites. FLAG, an 8-amino acid peptide, enables immunoaffinity purification
using commercially available monoclonal and polyclonal anti-FLAG antibodies (Eastman
Kodak). 6-His, a stretch of six consecutive histidine residues, enables purification on
metal-chelate resins (QIAGEN). Methods for protein expression and purification are
15 discussed in Ausubel (1995, supra, ch 10 and 16). Purified HTMPN obtained by these
methods can be used directly in the following activity assay.

X. Demonstration of HTMPN Activity

Given the chemical and structural similarity between the HTMPN and other
members of the transmembrane protein families, HTMPN is identified as a new member of
20 the membrane spanning proteins and is presumed to be involved in the regulation of cell
growth. To demonstrate that increased levels of HTMPN expression correlates with
decreased cell motility and increased cell proliferation, expression vectors encoding
HTMPN are electroporated into highly motile cell lines, such as U-937 (ATCC CRL
1593), HEL 92.1.7 (ATCC TIB 180) and MAC10, and the motility of the electroporated
25 and control cells are compared. Methods for the design and construction of an expression
vector capable of expressing HTMPN in the desired mammalian cell line(s) chosen are
well known to the art. Assays for examining the motility of cells in culture are known to
the art (cf Miyake, M. et al. (1991) J. Exp. Med. 174:1347-1354 and Ikeyama, S. et al.
(1993) J. Exp. Med. 177:1231-1237). Increasing the level of HTMPN in highly motile cell
30 lines by transfection with an HTMPN expression vector inhibits or reduces the motility of
these cell lines, and the amount of this inhibition is proportional to the activity of HTMPN
in the assay.

Alternatively, the activity of HTMPN may be measured using an assay based upon the property of MPs to support in vitro proliferation of fibroblasts and tumor cells under serum-free conditions. (Chiquet-Ehrismann, R. et al. (1986) Cell 47:131-139.) Wells in 96 well cluster plates (Falcon, Fisher Scientific, Santa Clara, CA) are coated with HTMPN by incubation with solutions at 50-100 µg HTMPN/ml for 15 min at ambient temperature. The coating solution is aspirated, and the wells washed with Dulbecco's medium before cells are plated. Rat fibroblast cultures or rat mammary tumor cells are prepared as described. (Chiquet-Ehrismann, R. et al. supra.) and plated at a density of 10⁴-10⁵ cells/ml in Dulbecco's medium supplemented with 10% fetal calf serum.

After three days the medium is removed, and the cells washed three times with phosphate-buffered saline (PBS), pH 7.0, before addition of serum-free Dulbecco's medium containing 0.25 mg/ml bovine serum albumin (BSA, Fraction V, Sigma Chemical Company, St. Louis, MO). After 2 days the medium is aspirated, and 100 µl of [³H]thymidine (NEN) at 2 µCi/ml in fresh Dulbecco's medium containing 0.25 mg/ml BSA is added. Parallel plates are fixed and stained to determine cell numbers. After 16 hr, the medium is aspirated, the cell layer washed with PBS, and the 10% trichloroacetic acid-precipitable radioactivity in the cell layer determined by liquid scintillation counting (normalized to relative cell numbers; Chiquet-Ehrismann, R. et al. supra). The amount of radioisotope-labeled DNA incorporated into chromatin under serum-free conditions is proportional to the activity of HTMPN.

Alternatively, HTMPN, or biologically active fragments thereof, are labeled with ¹²⁵I Bolton-Hunter reagent (See, e.g., Bolton et al. (1973) Biochem. J. 133:529). Candidate molecules previously arrayed in the wells of a multi-well plate are incubated with the labeled HTMPN, washed, and any wells with labeled HTMPN complex are assayed. Data obtained using different concentrations of HTMPN are used to calculate values for the number, affinity, and association of HTMPN with the candidate molecules.

XI. Functional Assays

HTMPN function is assessed by expressing the sequences encoding HTMPN at physiologically elevated levels in mammalian cell culture systems. cDNA is subcloned into a mammalian expression vector containing a strong promoter that drives high levels of cDNA expression. Vectors of choice include pCMV SPORT (Life Technologies) and pCR3.1 (Invitrogen, Carlsbad CA), both of which contain the cytomegalovirus promoter.

5-10 μ g of recombinant vector are transiently transfected into a human cell line, preferably of endothelial or hematopoietic origin, using either liposome formulations or electroporation. 1-2 μ g of an additional plasmid containing sequences encoding a marker protein are co-transfected. Expression of a marker protein provides a means to distinguish transfected cells from nontransfected cells and is a reliable predictor of cDNA expression from the recombinant vector. Marker proteins of choice include, e.g., Green Fluorescent Protein (GFP; Clontech), CD64, or a CD64-GFP fusion protein. Flow cytometry (FCM), an automated, laser optics-based technique, is used to identify transfected cells expressing GFP or CD64-GFP, and to evaluate properties, for example, their apoptotic state. FCM detects and quantifies the uptake of fluorescent molecules that diagnose events preceding or coincident with cell death. These events include changes in nuclear DNA content as measured by staining of DNA with propidium iodide; changes in cell size and granularity as measured by forward light scatter and 90 degree side light scatter; down-regulation of DNA synthesis as measured by decrease in bromodeoxyuridine uptake; alterations in expression of cell surface and intracellular proteins as measured by reactivity with specific antibodies; and alterations in plasma membrane composition as measured by the binding of fluorescein-conjugated Annexin V protein to the cell surface. Methods in flow cytometry are discussed in Ormerod, M. G. (1994) Flow Cytometry, Oxford, New York NY.

The influence of HTMPN on gene expression can be assessed using highly purified populations of cells transfected with sequences encoding HTMPN and either CD64 or CD64-GFP. CD64 and CD64-GFP are expressed on the surface of transfected cells and bind to conserved regions of human immunoglobulin G (IgG). Transfected cells are efficiently separated from nontransfected cells using magnetic beads coated with either human IgG or antibody against CD64 (DYNAL, Lake Success NY). mRNA can be purified from the cells using methods well known by those of skill in the art. Expression of mRNA encoding HTMPN and other genes of interest can be analyzed by northern analysis or microarray techniques.

XII. Production of HTMPN Specific Antibodies

HTMPN substantially purified using polyacrylamide gel electrophoresis (PAGE; see, e.g., Harrington, M.G. (1990) *Methods Enzymol.* 182:488-495), or other purification techniques, is used to immunize rabbits and to produce antibodies using standard

protocols.

Alternatively, the HTMPN amino acid sequence is analyzed using LASERGENE software (DNASTAR) to determine regions of high immunogenicity, and a corresponding oligopeptide is synthesized and used to raise antibodies by means known to those of skill
5 in the art. Methods for selection of appropriate epitopes, such as those near the C-terminus or in hydrophilic regions are well described in the art. (See, e.g., Ausubel, 1995, supra, ch. 11.)

Typically, oligopeptides 15 residues in length are synthesized using an ABI 431A Peptide Synthesizer (Perkin-Elmer) using fmoc-chemistry and coupled to KLH (Sigma-
10 Aldrich, St. Louis MO) by reaction with N-maleimidobenzoyl-N-hydroxysuccinimide ester (MBS) to increase immunogenicity. (See, e.g., Ausubel, 1995, supra.) Rabbits are immunized with the oligopeptide-KLH complex in complete Freund's adjuvant. Resulting antisera are tested for anti-peptide activity by, for example, binding the peptide to plastic, blocking with 1% BSA, reacting with rabbit antisera, washing, and reacting with radio-
15 iodinated goat anti-rabbit IgG.

XIII. Purification of Naturally Occurring HTMPN Using Specific Antibodies

Naturally occurring or recombinant HTMPN is substantially purified by immunoaffinity chromatography using antibodies specific for HTMPN. An immunoaffinity column is constructed by covalently coupling anti-HTMPN antibody to an
20 activated chromatographic resin, such as CNBr-activated SEPHAROSE (Amersham Pharmacia Biotech). After the coupling, the resin is blocked and washed according to the manufacturer's instructions.

Media containing HTMPN are passed over the immunoaffinity column, and the column is washed under conditions that allow the preferential absorbance of HTMPN (e.g.,
25 high ionic strength buffers in the presence of detergent). The column is eluted under conditions that disrupt antibody/HTMPN binding (e.g., a buffer of pH 2 to pH 3, or a high concentration of a chaotrope, such as urea or thiocyanate ion), and HTMPN is collected.

XIV. Identification of Molecules Which Interact with HTMPN

HTMPN, or biologically active fragments thereof, are labeled with ¹²⁵I
30 Bolton-Hunter reagent (See, e.g., Bolton et al. (1973) Biochem. J. 133:529). Candidate molecules previously arrayed in the wells of a multi-well plate are incubated with the labeled HTMPN, washed, and any wells with labeled HTMPN complex are assayed. Data

obtained using different concentrations of HTMPN are used to calculate values for the number, affinity, and association of HTMPN with the candidate molecules.

Various modifications and variations of the described methods and systems of the invention will be apparent to those skilled in the art without departing from the scope and spirit of the invention. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in molecular biology or related fields are intended to be within the scope of the following

10 claims.

Table 1

| Protein SEQ ID NO: | Nucleotide SEQ ID NO: | Clone ID | Library | Fragments |
|-----------------------|--------------------------|----------|------------|--|
| 1 | 80 | 153831 | THIPIPIB02 | 153831 (THIPIPIB02), 270074111 (OVARUT010), 881348R1 (THYRNOT02), 1856588F6 (PROSNOT18) |
| 2 | 81 | 350629 | LVENNOT01 | 350629 and 350629T6 (LVENNOT01), 3499109H1 (PROSTUT13) |
| 3 | 82 | 729171 | LUNGNOT03 | 729171 and 729171R6 (LUNGNOT03), 1645343H1 (HIEARFET01), 680519X2 and 680519X1 (UTRSNOT02), 625051R6 (PGANNO101), 1459466F1 (COLNFET02), 1225759T1 (COLNNOT01), 2590526H1 (LUNGNOT22), 2807811H1 (BLADTUT08) |
| 4 | 83 | 1273641 | TESTTUT02 | 1273641 and 1273641F6 (TESTTUT02), 1308181F6 and 1308181F1 (COLNFET02), 1427606F1 (SINTBST01), 756171H1 (BRAITUT02), 2416518F6 (HNT3AZT01), 4242346H1 (SYNWDIT01) |
| 5 | 84 | 1427389 | SINTBST01 | 1427389 (SINTBST01), 3097151H1 (CERVNOT03), 723779R1 (SYNOOAT01) |
| 6 | 85 | 1458357 | COLNFET02 | 1458357 (COLNFET02), SAOA01955F1, SAOA03146F1, SAOA03356F1, SAOA00213F1 |
| 7 | 86 | 1482837 | CORPNOT02 | 1482837 and 1482837T6 (CORPNOT02), 869453H1 (LUNGAST01), 3564972F6 (SKINNOT05), 663983H1 (SCORNOT01), 1315073F6 (BLADTUT02), 3809242H1 (CONTTUT01), 311459T6 (LUNGNOT02), 1798893F6 (COLNNOT27) |
| 8 | 87 | 1517434 | PANCTUT01 | 1517434 (PANCTUT01), 2848842H1 (BRSTTUT13), 586843X1 (UTRSNOT01), 1261245R1 (SYNORAT05), 1554505F1 (BLADTUT04) |
| 9 | 88 | 1536052 | SPLNNOT04 | 1536052 and 1531447T6 (SPLNNOT04), 1729124T6 (BRSTTUT08) |
| 10 | 89 | 1666118 | BRSTNOT09 | 1666118 (BRSTNOT09), 907075R2 (COLNNOT08), 1524914T1 (UCMCI.5T01), 1283459F6 (COLNNOT16) |
| 11 | 90 | 1675560 | BLADNOT05 | 1675560 and 1675560T6 (BLADNOT05) |
| 12 | 91 | 1687323 | PROSTUT10 | 1687323 and 1687323F6 (PROSTUT10), 2292356R3 (BRAINON01) |
| 13 | 92 | 1692236 | PROSTUT10 | 1692236 (PROSTUT10), 2786557F6 (BRSTNOT13), 602869R6 and 602869T6 (BRSTTUT01), 2258230H1 (OVARUT01), 780083T1 (MYOMNOT01), 2057230T6 (BEPINOT01), 288105R1 (EOSIHET02) |
| 14 | 93 | 1720847 | BLADNOT06 | 1720847, 1722250F6, and 1722250T6 (BLADNOT06) |

Table 1 (cont.)

| Protein SEQ ID NO: | Nucleotide SEQ ID NO: | Clone ID | Library | Fragments |
|-----------------------|--------------------------|----------|-----------|--|
| 15 | 94 | 1752821 | LIVRUT01 | 1752821 (LIVRUT01), 3180328H1 (TLYINOT01), 1969457T6 (BRSTNOT04), 2608504H1 (BONTNOT01), 2455688T6 and 2455688F6 (ENDANO101), 1816354F6 (PROSNOT20) |
| 16 | 95 | 1810923 | PROSTUT12 | 1810923 and 1810923T6 (PROSTUT12), 3221260H1 (COLNNON03) |
| 17 | 96 | 1822315 | GBLATUT01 | 1822315 (GBLATUT01), 1841726H1 (COLNNO107), 1598582T6 (BLADNO103), 1264125K1 (SYNORAT05), 645048H1 (BRSTTUT02), 1474782H1 (LUNGUT03), 352739F1 (LVENNOT01), 876001R1 (LUNGAST01) |
| 18 | 97 | 1877777 | LEUKNOT03 | 1877777 (LEUKNOT03), 1219656H1 (NEUTGMT01), 1471553T1 (LUNGUT03) |
| 19 | 98 | 1879819 | LEUKNOT03 | 1879819 (LEUKNOT03), 1734538H1 (COLNNOT22), 1428615F6 (SINTBST01), 3558710H1 (LUNGNOT13), 1996096R6 (BRSTTUT03) |
| 20 | 99 | 1932945 | COLNNOT16 | 1932945 (COLNNOT16), 2383333H1 (ISLINOT01), 2706050F6 (PONSAT01), |
| 21 | 100 | 2061026 | OVARNOT03 | 2061026 (OVARNOT03) |
| 22 | 101 | 2096687 | BRAITUT02 | 2096687 (BRAITUT02), 2204640H1 (SPLNFET02) |
| 23 | 102 | 2100530 | BRAITUT02 | 2100530 (BRAITUT02), 2740969F6 (BRSTTUT14) |
| 24 | 103 | 2357636 | LUNGNOT20 | 2357636 (LUNGNOT20), 2693537H1 (LUNGNOT23), 1794235T6 (PROSTUT05), 235425R6 (SINTNOT02), 760091R1 (BRAITUT02), 887877R1 (PANCNOT05) |
| 25 | 104 | 2365230 | ADRENOT07 | 2365230 (ADRENOT07), 2921195H1 (SININOT04) |
| 26 | 105 | 2455121 | ENDANO101 | 2455121 and 2455121F6 (ENDANO101) |
| 27 | 106 | 2472514 | THPINOT03 | 2472514 (THPINOT03), 3212904H1 (BLADNOT08) |
| 28 | 107 | 2543486 | UTRSNOT11 | 2543486 (UTRSNOT11), 2374764H1 (ISLINOT01), 1359576F1 (LUNGNOT12), 1357170H1 (LUNGNOT09) |
| 29 | 108 | 2778171 | OVARUT03 | 2778171 (OVARUT03), 1822045H1 (GBLATUT01), 1692535F6 (COLNNOT23), 1905275F6 (OVARNOT07) |

Table 1 (cont.)

| Protein SEQ ID NO: | Nucleotide SEQ ID NO: | Clone ID | Library | Fragments |
|-----------------------|--------------------------|----------|-----------|---|
| 30 | 109 | 2799575 | PENCNOT01 | 2799575 (PENCNOT01), 874115111 (LUNGAST01), 967837R1 (BRSTNOT05), 3235248T6 and 3235248F6 (COLNUCT03) |
| 31 | 110 | 2804955 | BLADTUT08 | 2804955 (BLADTUT08), 732534H1 (LUNGNOT03), 402168R1 (TMLR3DT01), 3481814H1 (KIDNNOT31), 1485989F1 (CORPNOT02) |
| 32 | 111 | 2806395 | BLADTUT08 | 2806395 (BLADTUT08), 1579109H1 (DUODNOT01), 1533572F1 (SPLNNOT04), 1889837F6 and 1889837T6 (BLADTUT07), 2414178F6 (HNT3AZT01) |
| 33 | 112 | 2836858 | TYMNOT03 | 2836858 and 2836858CT1 (TYMNOT03), 2127516H1 (KIDNNOT05) |
| 34 | 113 | 2844513 | DRGLNOT01 | 2844513 and 2844513T6 (DRGLNOT01), 388885T6 (THYMNOT02), 287344F1 (EOSIHET02), 3867626H1 (BMARNOT03) |
| 35 | 114 | 3000380 | TYMNOT06 | 3000380 (TYMNOT06), 1930658H1 (COLNTUT03), 2395295F6 (THPIAZT01), 1242456R6 (LUNGNOT03) |
| 36 | 115 | 182532 | PLACNOB01 | 062374111, 062962R6, 064457R6, and 182532111 (PLACNOB01), 3144248X12F1 (HNT2AZS07) |
| 37 | 116 | 239589 | HIPONOT01 | 239589H1 and 239589X13 (HIPONOT01), 264805R6 (HNT2AGT01), 552683X17 (SCORNOT01), 1595053F1 (BRAINT014) |
| 38 | 117 | 1671302 | BMARNOT03 | 399804H1 (PITUNOT02), 1458549H1 (COLNFET02), 1671302F6 and 1671302H1 (BMARNOT03), 2093453R6 (PANCNOT04), 2498385F6 and 2498385T6 (ADRETUT05) |
| 39 | 118 | 2041858 | HIPONON02 | 063184R1 (PLACNOB01), 1294823F1 (PGANNOT03), 1303974F1 (PLACNOT02), 1648770F6 (PROSTUT09), 2041858H1 (HIPONON02) |
| 40 | 119 | 2198863 | SPLNFET02 | 1880470F6 (LEUKNOT03), 1888946F6 (BLADTUT07), 2198863F6 and 2198863H1 (SPLNFET02) |
| 41 | 120 | 3250703 | SEMVNOT03 | 1317728H1, 1318433H1, 1319354H1, 1319380F1, 1320494111, and 1320812F1 (BLADNOT04), 3247874H1, 3249188H1, 3249385H1, and 3250703H1 (SEMVNOT03) |
| 42 | 121 | 350287 | LVENNOT01 | 062018F1 (PLACNOB01), 350287H1 (LVENNOT01), 869320R1 (LUNGAST01), 1416927F6 (BRAINT012), 3083789H1 (OVARFUN01) |
| 43 | 122 | 1618171 | BRAITUT12 | 1618171F6 and 1618171H1 (BRAITUT12), 3316315F6 (PROSBPT03) |

Table 1 (cont.)

| Protein SEQ ID NO: | Nucleotide SEQ ID NO: | Clone ID | Library | Fragments |
|-----------------------|--------------------------|----------|-----------|---|
| 44 | 123 | 1625863 | COLNPOT01 | 1625863H1 and 1625863T6 (COLNPOT01), 2100364R6 (BRAITUT02) |
| 45 | 124 | 1638353 | UTRSNOT06 | 1638353H1 (UTRSNOT06), 3733085H1 (SMCCNOS01), 3882774T6 (SPLNNOT11), 1626195T6 (COLNPOT01), 1495745H1 (PROSNON01) |
| 46 | 125 | 1726843 | PROSNOT14 | 826000T1 (PROSNOT06), 1726843F6 and 1726843H1 (PROSNOT14), 2225762F6 (SEMVNOT01), 2480248H1 (SMCANOT01), 2600692F6 (UTRSNOT10), 2728257F6 (OVARUT05) |
| 47 | 126 | 1754506 | LIVRTUT01 | 907854R2 (COLNNOT09), 1354345F1 (LUNGNOT09), 1359472F1 (LUNGNOT12), 1397284F1 (BRAITUT08), 1557921F1 (BLADTUT04), 1754506F6 and 1754506H1 (LIVRTUT01) |
| 48 | 127 | 1831378 | THP1AZT01 | 44154IR1 (MPHGNOT03), 712292R6 (SYNORAT04), 1311835F1 (COLNFET02), 1555765F6 (BLADTUT04), 1831378H1 (THP1AZT01), 1865502F6 (PROSNOT19), 3077521H1 (BONEUNT01), 3555043H1 (SYNONOT01), 3774618H1 (BRSTNOT25) |
| 49 | 128 | 1864943 | PROSNOT19 | 714070F1 (PROSTUT01), 736327R1 (TONSNOT01), 1864943H1 (PROSNOT19), 2672921F6 (KIDNNOT19) |
| 50 | 129 | 1911316 | CONNTUT01 | 777070F1 (COLNNOT05), 1911316H1 and 1911316T6 (CONNTUT01) |
| 51 | 130 | 1943120 | HIPONOT01 | 1516263F1 (PANCUTUT01), 1943120H1 (HIPONOT01), 2469009F6 (THYRNOT08), 2522459F6 (BRAITUT21), 3202972F6 (PENCNOT02), 4383679H1 (BRAVUTT02) |
| 52 | 131 | 2314236 | NGANNT01 | 2314236H1 (NGANNT01), 2812085F6 (OVARNOT10), 3949704T6 (DRGCNOT01) |
| 53 | 132 | 2479409 | SMCANOT01 | 2479409F6 and 2479409H1 (SMCANOT01) |
| 54 | 133 | 2683149 | SINIUCT01 | 760389H1 (BRAITUT02), 1634372F6 (COLNNOT19), 1695052F6 (COLNNO123), 1736429F6 (COLNNOT22), 2048429F6 (LIVRFET02), 2683149H1 (SINIUCT01), 3282234F6 (STOMFET02) |
| 55 | 134 | 2774051 | PANCNOT15 | 1852505F6 (LUNGFET03), 2774051F6 and 2774051H1 (PANCNOT15) |
| 56 | 135 | 2869038 | THYRNOT10 | 536017R6 (ADRENOT03), 2770632F6 (COLANOT02), 2795420F6 (NPOLNOT01), 2869038F6 and 2869038H1 (THYRNOT10), 3323992H1 (PTHYNOT03) |
| 57 | 136 | 2918334 | THYMFET03 | 2918334H1 (THYMFET03), SBNA01788F1 |

Table 1 (cont.)

| Protein SEQ ID NO: | Nucleotide SEQ ID NO: | Clone ID | Library | Fragments |
|-----------------------|--------------------------|----------|-----------|--|
| 58 | 137 | 2949916 | KIDNFET01 | 2949916H1 (KIDNFET01), SBMA00738F1 |
| 59 | 138 | 2989375 | KIDNFET02 | 437481R6 and 437481T6 (THYRNOT01), 2989375H1 (KIDNFET02) |
| 60 | 139 | 3316764 | PROSBPT03 | 1328462F1 (PANCNOT07), 1691807F6 (PROSTUT10), 1851237F6 (LUNGFEF03), 3316764H1 (PROSBPT03), 5092348H1 (UTRSTMR01) |
| 61 | 140 | 3359559 | PROSTUT16 | 943684 and 943564 (ADRENOT03), 1697079F6 (COLNNOT23), 2717735H1 (THYRNOT09), 2792705H1 (COLNTUT16), 3359559H1 (PROSTUT16) |
| 62 | 141 | 4289208 | BRABDIR01 | 3990421R6 (LUNGNON03), 4289208H1 (BRABDIR01) |
| 63 | 142 | 2454013 | ENDANOT01 | 014571R1 (THP1PLB01), 1303790T1 (PLACNOT02), 1342791T1 (COLNTUT03), 1351680F1 (LATRTUT02), 1359607T1 (LUNGNOT12), 2454013F6 and 2454013H1 (ENDANOT01) |
| 64 | 143 | 2454048 | ENDANOT01 | 551329R1 and 2056675R6 (BEPINOT01), 819281R1 (KERANOT02), 2454048H1 (ENDANOT01), 3143588H1 (HNT2AZS07) |
| 65 | 144 | 2479282 | SMCANOT01 | 873307R1 (LUNGAST01), 2479282H1 and 2479282T6 (SMCANOT01), 2610082F6 (COLNTUT15), SANA03636F1 |
| 66 | 145 | 2483432 | SMCANOT01 | 940455T1 (ADRENOT03), 1863558T6 (PROSNOT19), 2483432H1 (SMCANOT01), 2641345H1 (LUNGSTUT08), 3245089T6 (BRAINOI19), SBCA02765F1 |
| 67 | 146 | 2493824 | ADRETUT05 | 489685F1 (HNT2AGT01), 530794H1 (BRAINOI03), 735826R1 (TONSNOT01), 2056809R6 (BEPINOT01), 2493824H1 (ADRETUT05), 2763162F6 (BRSTNOT12), 2812426H1 (OVARNOT10) |
| 68 | 147 | 2555823 | THYMNOT03 | 1266972F6 (BRAINOI09), 1335461T1 (COLNNOT13), 1900947F6 (BLADTUT06), 1942256T6 (HIPONOT01), 2555823H1 (THYMNOT03), SARB01019F1, SARB01303F1 |
| 69 | 148 | 2598242 | OVARUT02 | 320268F1 (EOSIHET02), 738915R1 (PANCNOT04), 1250161F1 (LUNGFEF03), 2598242F6 and 2598242H1 (OVARUT02), 5020793H1 (OVARNON03), SASA00178F1 |
| 70 | 149 | 2634120 | COLNTUT15 | 1398694F1 (BRAITUT08), 1506594F1 (BRAITUT07), 2120954F6 (BRSTNOT07), 2634120F6 and 2634120H1 (COLNTUT15), 2761586H1 (BRAINOS12), 2806841F6 (BLADTUT08) |

Table 1 (cont.)

| Protein SEQ ID NO: | Nucleotide SEQ ID NO: | Clone ID | Library | Fragments |
|-----------------------|--------------------------|----------|-----------|---|
| 71 | 150 | 2765411 | BRSTNOT12 | 27652361F6 and 27654111H1 (BRSTNOT12), 40582181H1 (SP1NNOT13) |
| 72 | 151 | 2769412 | COLANOT02 | 1715480F6 (UCMCNOT02), 2769412H1 (COLANOT02), SBDA04076F1 |
| 73 | 152 | 2842779 | DRGLNOT01 | 1262711R1 (SYNORAT05), 1710449T6 (PROSNOT16), 2842779F6 (DRGLNOT01), 2842779H1 (DRGLNOT01), 2850941F6 (BRSTTUT13), 3123378H1 (L.NODNOT05), 3457873H1 (293FIT01), SBGA04623F1, SAOA02667F1 |
| 74 | 153 | 2966260 | SCORNOT04 | 530242H1 (BRAINOT03), 2113607H1 (BRAITUT03), 2125619F6 (BRSTNOT07), 2155349H1 and 2156022H1 (BRAINOT09), 2966260F6, 2966260H1, and 2966260T6 (SCORNOT04), 3270731H1 (BRAINOT20), 3272328F6 (PROSBPT06) |
| 75 | 154 | 2993326 | KIDNFET02 | 190217F1 (SYNORAB01), 815990R1 and 815990T1 (OVARTUT01), 2993326H1 (KIDNFET02), 3629860H1 (COLNNOT38) |
| 76 | 155 | 3001124 | TLYMNOT06 | 2123347T6 (BRSTNOT07), 3001124H1 (TLYMNOT06), SBEA07088F3 |
| 77 | 156 | 3120070 | LUNGTUT13 | 021565F1 (ADENINB01), 144798R1 (TLYMNOR01), 1216676H1 (BRSTTUT01), 2024357H1 (KERANOT02), 2616322H1 (GBLANOT01), 2742604H1 (BRSTTUT14), 2746025H1 (LUNGTUT11), 2924884H1 (SININOT04), 3120070H1 (LUNGTUT13) |
| 78 | 157 | 3133035 | SMCCNOT01 | 1478001F1 and 1482667H1 (CORPNOT02), 2812193F6 and 2812193T6 (OVARNOT10), 3133035H1 and 3133035T6 (SMCCNOT01), 5025075F6 (OVARNON03) |
| 79 | 158 | 3436879 | PENCNOT05 | 3323031F6 (PTHYNOT03), 3436879F6 and 3436879H1 (PENCNOT05), 4247733H1 (BRABDIT01) |

Table 2

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|---|-------------------------------|--------------------|---------------------------------------|---------------------|
| 1 | 240 | S233 S159 T194 T43 T77 T129 T134 S171 | N73 N101 N167 | S33-G36 L198-L219 | Somatostatin receptor tyrosine kinase | BLAST, BLOCKS, HMM |
| 2 | 100 | S6 S64 | | | Meningioma-expressed antigen 11 | BLAST, PRINTS, HMM |
| 3 | 416 | S14 S62 T109 T177 T340 S365 S380 S6 T7 T205 S327 T331 Y56 | N144 N277 | | PMP-22/EMP/MP20 family | BLOCKS, PRINTS, HMM |
| 4 | 224 | T31 T57 S86 S173 S214 | | | B cell growth factor | BLAST |
| 5 | 247 | S103 T60 S113 S235 | | | 5-hydroxytryptamine receptor | PRINTS |
| 6 | 72 | | | | Frizzled protein | PRINTS, HMM |
| 7 | 106 | S97 S9 S24 T31 | | | Dopamine 2 receptor | BLAST, PRINTS, HMM |
| 8 | 239 | S233 | N230 | | PB39 protein | BLAST, HMM |
| 9 | 150 | S53 S111 T127 | | | CD44 antigen precursor | PRINTS, HMM |
| 10 | 110 | S12 | N92 | | Anion exchanger | BLOCKS, PRINTS, HMM |
| 11 | 58 | | N5 N9 | | Neurofibromatosis type 2 | BLAST, PRINTS, HMM |
| 12 | 221 | S35 S178 S60 S183 | | | mitsugumin 23 | BLAST, HMM |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|---|-------------------------------|--------------------|--------------------------------------|---------------------|
| 13 | 262 | T33 S94 S150 T225 T245 T114 S22 T30 T57 S137 T201 S207 T230 | N104 | | C5a-anaphylatoxin receptor | PRINTS, HMM |
| 14 | 90 | S67 T52 | | | Frizzled protein | PRINTS, HMM |
| 15 | 208 | T119 T123 T132 S56 S142 | N121 | | Rieske iron-sulphur protein | BLOCKS, PRINTS, HMM |
| 16 | 97 | S61 T2 | | | Endothelin B receptor | PRINTS, HMM |
| 17 | 243 | S82 T104 S168 T181 S6 S99 T195 Y24 | | | Thromboxane receptor | PRINTS, HMM |
| 18 | 162 | S26 | N6 | | G protein-couple receptor | BLOCKS, PRINTS, HMM |
| 19 | 470 | S285 S29 T136 S145 T167 T168 S199 S236 S249 T401 S172 S209 S254 T264 S335 T385 | N118 N298 N466 | R306-D308 | Molluscan rhodopsin C-terminus | PRINTS, HMM |
| 20 | 144 | S42 S21 T72 | N30 N36 | | Lysosome-associated membrane protein | PRINTS, HMM |
| 21 | 221 | S75 T82 | | S151-G154 | Glycoprotein hormone receptor | BLAST, PRINTS, HMM |
| 22 | 688 | T60 T186 T103 T298 S405 S484 S488 S492 S494 S498 S499 S503 S584 S601 S611 S647 T663 T109 T188 T284 T315 S324 S347 T402 T573 S643 T658 T681 Y118 | N198 N576 N577 N582 | S5-G8 A80-N140 | Ring3 | BLAST, PRINTS |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|---|-------------------------------|--------------------|--|----------------------------|
| 23 | 439 | T75 T257 S397 S424 S210 S435 | N227 | S365-G368 | Prostanoid EP3 receptor | BLOCKS, PRINTS |
| 24 | 192 | S20 S44 | N68 | | PMP-22/EMP/MP20 family | BLOCKS, PRINTS, IIMM |
| 25 | 175 | T171 T43 S136 T7 | | | Progesterone receptor | PRINTS |
| 26 | 91 | S34 S19 S29 | | | Similar to mouse dishevelled-3(Dvl-3). | BLAST, BLOCKS, PRINTS, HMM |
| 27 | 214 | T34 S83 T118 T152 S17 | | | Somatostatin receptor tyrosine kinase | BLOCKS, PRINTS, HMM |
| 28 | 250 | S64 S132 T154 | | | Sec22 homolog | BLAST, HMM |
| 29 | 84 | T80 T3 S76 | | | DPM2 protein | BLAST, HMM |
| 30 | 277 | T140 S217 S19 S85 T129 | | | Somatostatin B domain protein | BLOCKS, PRINTS, HMM |
| 31 | 273 | S64 S4 S114 S179 S256 S14 T167 T218 | N187 | | Anion exchanger family | BLOCKS, PRINTS, IIMM |
| 32 | 524 | T190 S5 T131 S148 S171 S262 S275 T302 S356 S404 S473 S177 S207 T492 | N152 N471 N501 N513 | I.46-I.67 | G protein-coupled receptor | BLOCKS, PRINTS, IIMM |
| 33 | 257 | S48 S52 S55 T64 S82 T90 S96 T97 S123 T129 T144 S192 S224 T227 S250 | N98 N187 | | Nucleoporin p62 homolog | BLAST |
| 34 | 274 | S16 T84 S249 S56 S113 | N234 | | Molluscan rhodopsin C-terminus | PRINTS |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|--|-------------------------------|--|--|-------------------------------|
| 35 | 281 | S52 T150 S165 S263 T48 S116 T167 T226 T241 | | G125-S132 S185-G188 | ABC-2 type transport protein | BLOCKS, PRINTS, HMM |
| 36 | 335 | S96 T113 T131 T308 T14 T146 T292 S302 S312 T317 Y258 | N104 N111 | E296 to A307 R127 to G129 | pregnancy-specific beta 1-glycoprotein 4 precursor | Blast, BLOCKS, PRINTS, Motifs |
| 37 | 280 | T41 S102 T135 S148 | N35 N53 N127 | T56 to Y70 | lysosomal membrane glycoprotein-type A precursor | Blast, BLOCKS, PRINTS, Motifs |
| 38 | 210 | S50 S143 S151 S63 S107 S153 | | | Butyrophilin | Blast |
| 39 | 279 | T90 | N66 N171 | | Plasma membrane glycoprotein CIG30 | Blast |
| 40 | 154 | T75 S121 S48 S58 T112 Y84 Y90 | | G101 to G122 V115 to F130 | Pathogenesis-related protein PR-1 | Blast, BLOCKS, PRINTS |
| 41 | 582 | S160 S255 T256 S291 S292 S316 S351 S352 S411 S412 S471 S472 T485 S533 T559 S79 T93 S96 S151 S231 | | G520 to S527 | semenogelin II | Blast, Motifs |
| 42 | 71 | S17 T45 T50 | | M1 to T50 P5 to C29 | Integral membrane protein | BLOCKS, PRINTS |
| 43 | 102 | T44 S33 T75 | | S6 to L24 S33 to G36 I49 to I74 A2 to S29 | TM4SF | BLOCKS, PRINTS, HMM |
| 44 | 226 | S60 T3 T4 S85 T169 | N46 N82 N83 | I184 to R205 G128 to Q152 Y179 to Y201 | Cation-dependant mannose transporter protein | PRINTS, HMM |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|--|-------------------------------|--|-------------------------------------|-----------------------------|
| 45 | 154 | T145 T148 S33 T134 T141 S152 | | M1 to A22 P56 to M78 P58 to M82 L91 to S110 L109 to L125 | Frizzled protein | PRINTS, HMM |
| 46 | 167 | S154 S3 T25 T29 T126 S140 | | E72 to F103 | GPCR | BLOCKS, PRINTS, HMM |
| 47 | 545 | T257 S513 S10 T11 S47 S166 S408 S495 | N8 N406 | E376 to K410 | Human secreted protein K640 variant | Blast, BLOCKS, PRINTS, HMM |
| 48 | 570 | T529 S128 S130 T184 T235 T161 S293 Y199 | N27 N61 N75 N87 N264 | V296 to C309 F321 to F332 | GPCR | Blast, BLOCKS, PRINTS, HMM |
| 49 | 127 | S24 T118 | | N10 to G30 | Anion exchanger | PRINTS, HMM |
| 50 | 152 | T49 S16 | | L78 to L99 L85 to L106 V47 to Y63 Y45 to V94 | TM4SF GNS1/SUR4 family | BLOCKS, HMM, Motifs |
| 51 | 777 | T48 S66 S162 T268 S272 T322 T355 S393 S471 S559 S574 S624 S660 S700 T742 S750 S11 T12 S196 S346 T400 S423 T493 T579 T582 S599 S723 | N64 N205 N470 N706 | T20 to D34 R122 to L132 L598 to L619 D331 to L349 R565 to T582 | pecanex protein | Blast, PRINTS, Motifs |
| 52 | 108 | S52 T31 T105 | | L76 to Y92 | GNS1/SUR4 family | BLOCKS, PRINTS, PROFILESCAN |
| 53 | 66 | S4 S35 | N2 | F22 to G58 | NF2 protein | Blast, BLOCKS, PRINTS, HMM |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|----------------------------------|-------------------------------|--|---|-----------------------------|
| 54 | 540 | S135 S149 T527 T82 T94 T177 S441 | N50 N92 N160 N334 N395 | S115 to G118 L295 to L308 L490 to L518 | I.IV-I protein | Blast, PRINTS, HMM, Motifs |
| 55 | 87 | T4 S13 S37 S68 S69 | | I46 to I.82 | calveolin | BLOCKS, HMM |
| 56 | 100 | S94 | | I7 to N34 G8 to F21 K65 to N91 T78 to C97 | ammonium ion transporters | BLOCKS, PRINTS, HMM |
| 57 | 58 | T43 | | | shox protein | BLAST, HMM |
| 58 | 61 | S51 S58 S42 | | R2 to L23 | carboxyl ester lipase | Blast, PRINTS, HMM |
| 59 | 50 | S9 | | C33 to W45 C11 to L40 | Lipoxygenase; growth factor and cytokines receptor family | BLOCKS, PRINTS, HMM, Motifs |
| 60 | 310 | T46 T156 S301 T81 S108 S166 S305 | | A153 to S166 | C4 methyl-sterol oxidase | Blast, PRINTS, HMM |
| 61 | 160 | S114 | | L71 to W84 Y143 to T154 | C5A-anaphylatoxin receptor | Blast, BLOCKS, PRINTS, HMM |
| 62 | 35 | | | K11 to M34 | steroid hormone receptor | PRINTS |
| 63 | 323 | T92 S105 S182 T263 S301 S271 | N90 | M1-G31 Signal Peptide M1-A27 Signal Peptide L234-L254 TM Protein | Signal Peptide Containing Transmembrane Protein | Motifs SPScan HMM |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|---|-------------------------------|---|---|-----------------------------------|
| 64 | 129 | T112 T117 S5 S54 | | M1-G27 Signal Peptide M1-G27 Signal Peptide I81-V100 TM Prot. | Signal Peptide Containing Transmembrane Protein | Motifs SPScan HMM |
| 65 | 461 | T56 T41 S47 T56 T127 S146 S147 S197 S198 T407 S8 S47 T51 T284 T341 T407 | N193 N236 | | Signal Peptide Containing Transmembrane Protein | Motifs |
| 66 | 264 | S243 T264 S33 T211 S260 S22 S243 S260 | N172 N250 | M1-A17 Signal Peptide M1-S22 Signal Peptide L173-Y195TM Prot. M1-L21 TM Prot. L25-R30 Prot. Splicing | Protein Splicing Protein | Motifs SPScan HMM BLOCKS |
| 67 | 339 | T99 S119 S157 S166 S321 T54 S55 T77 S149 S211 S279 T336 Y105 | N172 | M1-G30 Signal Peptide M1-G26 Signal Peptide L176-L194 TM. Prot. | Signal Peptide Containing Transmembrane Protein | Motifs SPScan HMM |
| 68 | 397 | S104 T148 T166 T259 S303 S317 T127 T191 S302 | | G202-S209 ATP/GTP binding L10-L31 Leucine zipper D106-L108 Ca binding S367-L384 Signal Peptide M1-G29 Transmembr. Prot. | Gene Regulatory Protein | Motifs SPScan BLAST HMM |
| 69 | 301 | T7 S52 S100 S133 S239 T155 T206 | N162 N211 | V12-A32 TM. Prot. V282-G300 TMr. Prot. L59-V64 aatRNA ligase | Aminoacyl tRNA ligase | Motifs HMM BLOCKS |
| 70 | 217 | S8 S142 T112 T197 | | W73-I99 TM. Prot. | Cell Proliferation Protein | Motifs HMM |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|--|-------------------------------|--|---|----------------------------------|
| 71 | 143 | S81 T120 S139 S116 | | M1-C26 Signal Peptide M1-R25 Signal Peptide M1-V22 TM Prot. | Signal Peptide Containing Transmembrane Protein | Motifs SPScan HMM |
| 72 | 186 | T50 S132 T151 S116 Y43 | N29 N104 | M1-S25 Signal Peptide M1-S31 Signal Peptide F9-F28 TM Prot. A27-G891 T-cell receptor interacting molecule | T-cell Receptor Interacting Molecule | Motifs SPScan HMM BLAST |
| 73 | 364 | S172 S213 S243 S302 | N229 | L234-L255 Leucine zipper M1-G28 Signal Peptide L151-L170 TM. Prot. L72-E92 TM Prot. | Gene Regulatory Protein | Motifs SPScan HMM |
| 74 | 605 | S46 T54 S108 S129 S195 S220 S231 T254 T261 S316 S440 S472 S536 S560 T124 | N106 N193 N395 N480 | M1-A32 Signal Peptide V494-I515 TM. Prot. L17-E36 TM Prot. | 2-Membrane Spanning Signal Peptide Containing Transmembrane Protein | Motifs SPScan HMM |
| 75 | 97 | T2 S87 | | M1-G26 Signal Peptide M1-G23 Signal Peptide V35-M54 TM. Prot. I11-I34 TM Prot. | 2-Membrane Spanning Signal Peptide Containing Transmembrane Protein | Motifs SPScan HMM |
| 76 | 247 | S160 T204 S165 | | F72-L90 Transmembr. Prot. L45-T64 Transmembr. Prot. | 2-Membrane Spanning Signal Peptide Containing Transmembrane Protein | Motifs HMM |

Table 2 (cont.)

| SEQ ID NO: | Amino Acid Residues | Potential Phosphorylation Sites | Potential Glycosylation Sites | Signature Sequence | Identification | Analytical Methods |
|------------|---------------------|---------------------------------|-------------------------------|---|------------------------------|-----------------------------------|
| 77 | 193 | S60 S67 | | M1-D26 Signal Peptide M1-A31 Signal Peptide M80-M104 TM Prot. R109-Y129 TM Prot. S67-L108 PMP-22 Y149-Y176 PMP-22 N150-A159 Trehalase | Peripheral Myelin Protein 22 | Motifs SPScan HMM BLOCKS |
| 78 | 128 | S30 S30 S50 | N71 N84 N91 | N126-L128 microbodies targeting motif | Microbody Protein | Motifs |
| 79 | 115 | S109 | | M1-S16 Signal Peptide M1-T24 Signal Peptide M1-W19 TM Prot. V27-Y46 TM Prot. V5-V15 G Prot. Receptor | G Protein Receptor | Motifs SPScan HMM PRINTS |

Table 3

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|---|--|-------------|
| 80 | Reproductive (0.321) Cardiovascular (0.143) Gastrointestinal (0.134) | Cancer (0.527) Inflammation (0.232) Fetal (0.170) | pBLUESCRIPT |
| 81 | Cardiovascular (0.500) Gastrointestinal (0.250) Other (0.250) | Cancer (0.500) Fetal (0.250) Other (0.250) | pBLUESCRIPT |
| 82 | Reproductive (0.260) Cardiovascular (0.220) Gastrointestinal (0.120) | Cancer (0.500) Inflammation (0.180) Fetal (0.160) | pSPORT 1 |
| 83 | Nervous (0.400) Gastrointestinal (0.300) Developmental (0.100) | Cancer (0.500) Inflammation (0.300) Fetal (0.200) | pINCY 1 |
| 84 | Reproductive (0.266) Gastrointestinal (0.141) Cardiovascular (0.125) | Cancer (0.469) Inflammation (0.250) Fetal (0.195) | pINCY 1 |
| 85 | Reproductive (0.750) Developmental (0.250) | Cancer (0.750) Fetal (0.250) | pINCY 1 |
| 86 | Reproductive (0.250) Cardiovascular (0.143) Nervous (0.143) | Inflammation (0.321) Trauma (0.286) Cancer (0.250) | pINCY 1 |
| 87 | Reproductive (0.368) Developmental (0.158) Cardiovascular (0.105) | Cancer (0.421) Fetal (0.368) Inflammation (0.211) | pINCY 1 |
| 88 | Hematopoietic/Immune (0.417) Cardiovascular (0.250) Reproductive (0.167) | Inflammation (0.417) Cancer (0.333) Fetal (0.167) | pINCY 1 |
| 89 | Cardiovascular (0.220) Nervous (0.171) Reproductive (0.122) | Cancer (0.463) Inflammation (0.195) Trauma (0.171) | pINCY 1 |
| 90 | Gastrointestinal (0.200) Reproductive (0.200) Urologic (0.200) | Cancer (0.500) Inflammation (0.300) Other (0.100) | pINCY 1 |

Table 3 (cont.)

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|--|--|----------|
| 91 | Reproductive (0.306) Cardiovascular (0.204) Nervous (0.122) | Cancer (0.510) Inflammation (0.204) Fetal (0.143) | pINCY I |
| 92 | Reproductive (0.227) Hematopoietic/Immune (0.182) Cardiovascular (0.136) | Cancer (0.432) Fetal (0.273) Inflammation (0.273) | pINCY I |
| 93 | Gastrointestinal (0.375) Reproductive (0.188) Cardiovascular (0.125) | Cancer (0.500) Inflammation (0.250) Trauma (0.125) | pINCY I |
| 94 | Reproductive (0.333) Cardiovascular (0.214) Gastrointestinal (0.143) | Cancer (0.548) Inflammation (0.167) Fetal (0.143) | pINCY I |
| 95 | Cardiovascular (0.231) Gastrointestinal (0.231) Reproductive (0.192) | Cancer (0.500) Inflammation (0.231) Fetal (0.154) | pINCY I |
| 96 | Gastrointestinal (0.208) Cardiovascular (0.167) Reproductive (0.167) | Cancer (0.542) Inflammation (0.292) Other (0.083) | pINCY I |
| 97 | Hematopoietic/Immune (0.341) Reproductive (0.268) Cardiovascular (0.122) | Cancer (0.415) Inflammation (0.415) Fetal (0.195) | pINCY I |
| 98 | Gastrointestinal (0.346) Reproductive (0.231) Hematopoietic/Immune (0.154) | Inflammation (0.462) Cancer (0.385) Fetal (0.115) | pSPORT I |
| 99 | Gastrointestinal (0.400) Developmental (0.200) Nervous (0.200) | Cancer (0.400) Fetal (0.200) Neurological (0.200) | pSPORT I |
| 100 | Reproductive (0.231) Nervous (0.168) Cardiovascular (0.140) | Cancer (0.441) Inflammation (0.231) Fetal (0.133) | pSPORT I |
| 101 | Hematopoietic/Immune (0.225) Reproductive (0.225) Gastrointestinal (0.125) | Cancer (0.475) Inflammation (0.325) Fetal (0.175) | pINCY I |
| 102 | Reproductive (0.333) Gastrointestinal (0.185) Nervous (0.148) | Cancer (0.630) Fetal (0.185) Inflammation (0.111) | pINCY I |

Table 3 (cont.)

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|---|--|---------|
| 103 | Gastrointestinal (0.242) Reproductive (0.182) Developmental (0.121) | Cancer (0.455) Inflammation (0.364) Fetal (0.182) | pINCY I |
| 104 | Gastrointestinal (0.188) Hematopoietic/Immune (0.188) Urologic (0.188) | Inflammation (0.438) Cancer (0.281) Fetal (0.250) | pINCY I |
| 105 | Urologic (0.250) Cardiovascular (0.167) Gastrointestinal (0.167) | Fetal (0.500) Cancer (0.417) Inflammation (0.333) | pINCY I |
| 106 | Hematopoietic/Immune (0.333) Urologic (0.333) | Cancer (0.333) Fetal (0.333) Inflammation (0.333) | pINCY I |
| 107 | Reproductive (0.286) Cardiovascular (0.204) Nervous (0.184) | Cancer (0.592) Fetal (0.143) Inflammation (0.143) | pINCY I |
| 108 | Reproductive (0.231) Gastrointestinal (0.215) Hematopoietic/Immune (0.154) | Cancer (0.462) Inflammation (0.292) Fetal (0.185) | pINCY I |
| 109 | Reproductive (0.304) Cardiovascular (0.261) Gastrointestinal (0.130) | Cancer (0.609) Inflammation (0.174) Trauma (0.087) | pINCY I |
| 110 | Reproductive (0.256) Gastrointestinal (0.186) Hematopoietic/Immune (0.186) | Cancer (0.558) Inflammation (0.349) Trauma (0.070) | pINCY I |
| 111 | Nervous (0.200) Reproductive (0.200) Gastrointestinal (0.175) | Cancer (0.550) Fetal (0.175) Inflammation (0.150) | pINCY I |
| 112 | Developmental (0.222) Endocrine (0.222) Hematopoietic/Immune (0.222) | Cancer (0.222) Inflammation (0.222) Fetal (0.222) | pINCY I |
| 113 | Hematopoietic/Immune (0.267) Nervous (0.200) Gastrointestinal (0.133) | Cancer (0.467) Trauma (0.267) Inflammation (0.200) | pINCY I |
| 114 | Hematopoietic/Immune (0.304) Gastrointestinal (0.130) Nervous (0.130) | Inflammation (0.391) Cancer (0.304) Fetal (0.130) | pINCY I |

Table 3 (cont.)

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|---|---|-------------|
| 115 | Developmental (0.333) Cardiovascular (0.167) Dermatologic (0.167) | Fetal (0.667) Inflammation (0.500) | pBLUESCRIPT |
| 116 | Nervous (0.478) Gastrointestinal (0.130) Hematopoietic/Immune (0.130) | Cancer (0.565) Fetal (0.217) Inflammation (0.217) | pBLUESCRIPT |
| 117 | Reproductive (0.222) Hematopoietic/Immune (0.200) Nervous (0.156) | Cancer (0.422) Inflammation (0.311) Fetal (0.178) | pINCY |
| 118 | Reproductive (0.256) Gastrointestinal (0.148) Nervous (0.125) | Cancer (0.430) Inflammation (0.259) Fetal (0.196) | pSPORT1 |
| 119 | Reproductive (0.190) Nervous (0.167) Developmental (0.143) | Cancer (0.381) Inflammation (0.333) Fetal (0.262) | pINCY |
| 120 | Reproductive (0.800) Urologic (0.100) | Cancer (0.900) Trauma (0.100) | pINCY |
| 121 | Reproductive (0.295) Nervous (0.182) Cardiovascular (0.159) | Cancer (0.455) Inflammation (0.182) Cell Proliferation (0.159) | pBLUESCRIPT |
| 122 | Developmental (0.250) Musculoskeletal (0.250) Nervous (0.250) | Cancer (0.500) Cell Proliferation (0.250) Inflammation (0.250) | pINCY |
| 123 | Gastrointestinal (0.786) Developmental (0.071) Nervous (0.071) | Cancer (0.500) Inflammation (0.429) Cell Proliferation (0.071) | pINCY |
| 124 | Reproductive (0.348) Cardiovascular (0.159) Hematopoietic/Immune (0.130) | Cancer (0.493) Inflammation (0.246) Cell Proliferation (0.145) | pINCY |
| 125 | Nervous (0.405) Reproductive (0.324) Cardiovascular (0.108) | Cancer (0.459) Proliferation (0.189) Inflammation (0.108) | pINCY |
| 126 | Reproductive (0.275) Nervous (0.231) Gastrointestinal (0.154) | Cancer (0.549) Inflammation (0.220) Cell Proliferation (0.154) | pINCY |

Table 3 (cont.)

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|---|---|-------------|
| 127 | Reproductive (0.250) Nervous (0.150) Cardiovascular (0.133) | Cancer (0.517) Cell Proliferation (0.350) Inflammation (0.233) | pINCY |
| 128 | Nervous (0.333) Reproductive (0.333) Hematopoietic/Immune (0.111) | Cancer (0.593) Inflammation (0.259) Neurological (0.111) | pINCY |
| 129 | Hematopoietic/Immune (0.304) Gastrointestinal (0.214) Reproductive (0.196) | Cancer (0.446) Inflammation (0.446) Cell Proliferation (0.161) | pINCY |
| 130 | Nervous (0.400) Reproductive (0.300) Endocrine (0.100) | Cancer (0.300) Inflammation (0.300) Cell Proliferation (0.200) | pBLUESCRIPT |
| 131 | Reproductive (0.364) Cardiovascular (0.227) Nervous (0.227) | Cancer (0.545) Inflammation (0.318) Cell Proliferation (0.091) | pSPORT1 |
| 132 | Cardiovascular (0.667) Nervous (0.333) | Cell Proliferation (1.000) Cancer (0.333) | pINCY |
| 133 | Gastrointestinal (0.750) Developmental (0.125) Reproductive (0.083) | Cancer (0.375) Cell Proliferation (0.292) Inflammation (0.250) | pINCY |
| 134 | Cardiovascular (0.250) Developmental (0.250) Gastrointestinal (0.250) | Cancer (0.500) Cell Proliferation (0.500) Inflammation (0.250) | pINCY |
| 135 | Reproductive (0.250) Nervous (0.208) Endocrine (0.167) | Inflammation (0.417) Cancer (0.208) Trauma (0.167) | pINCY |
| 136 | Developmental (0.500) Reproductive (0.500) | Cancer (0.500) Cell Proliferation (0.500) | pINCY |
| 137 | Developmental (1.000) | Cell Proliferation (1.000) | pINCY |
| 138 | Developmental (0.333) Endocrine (0.333) Gastrointestinal (0.333) | Cancer (0.666) Fetal (0.333) | pINCY |
| 139 | Reproductive (0.538) Developmental (0.154) Gastrointestinal (0.154) | Cancer (0.462) Inflammation (0.231) Cell Proliferation (0.154) | pINCY |

Table 3 (cont.)

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|---|---|-------------|
| 140 | Gastrointestinal (0.385) Endocrine (0.231) Reproductive (0.231) | Cancer (0.308) Inflammation (0.308) Cell Proliferation (0.077) | pINCY |
| 141 | Nervous (0.500) Cardiovascular (0.167) Gastrointestinal (0.167) | Cancer (0.333) Trauma (0.333) Neurological (0.167) | pINCY |
| 142 | Reproductive (0.220) Gastrointestinal (0.155) Nervous (0.152) | Cell Proliferation (0.637) Inflammation (0.312) | pBLUESCRIPT |
| 143 | Cardiovascular (0.202) Reproductive (0.190) Gastrointestinal (0.179) | Cell Proliferation (0.583) Inflammation (0.322) | pBLUESCRIPT |
| 144 | Reproductive (0.242) Nervous (0.158) Gastrointestinal (0.116) | Cell Proliferation (0.632) Inflammation (0.379) | pINCY |
| 145 | Cardiovascular (0.238) Reproductive (0.238) Nervous (0.143) | Cell Proliferation (0.619) Inflammation (0.476) | pINCY |
| 146 | Reproductive (0.235) Nervous (0.189) Hematopoietic/Immune (0.131) | Cell Proliferation (0.625) Inflammation (0.348) | pINCY |
| 147 | Reproductive (0.191) Hematopoietic/Immune (0.173) Nervous (0.145) | Cell Proliferation (0.582) Inflammation (0.455) | pINCY |
| 148 | Reproductive (0.279) Hematopoietic/Immune (0.140) Nervous (0.128) | Cell Proliferation (0.674) Inflammation (0.232) | pINCY |
| 149 | Reproductive (0.286) Nervous (0.214) Cardiovascular (0.095) | Cell Proliferation (0.834) Inflammation (0.215) | pINCY |
| 150 | Hematopoietic/Immune (0.400) Endocrine (0.200) Gastrointestinal (0.200) | Cell Proliferation (0.200) Inflammation (0.800) | pINCY |
| 151 | Hematopoietic/Immune (0.667) Gastrointestinal (0.167) Musculoskeletal (0.167) | Cell Proliferation (0.167) Inflammation (0.667) | pINCY |

Table 3 (cont.)

| Nucleotide SEQ ID NO: | Tissue Expression (Fraction of Total) | Disease Class (Fraction of Total) | Vector |
|--------------------------|---|---|--------|
| 152 | Reproductive (0.240) Nervous (0.173) Hematopoietic/Immune (0.133) | Cell Proliferation (0.546) Inflammation (0.360) | pINCY |
| 153 | Reproductive (0.308) Nervous (0.231) Gastrointestinal (0.115) | Cell Proliferation (0.885) Inflammation (0.154) | pINCY |
| 154 | Nervous (0.455) Reproductive (0.182) Developmental (0.136) | Cell Proliferation (0.682) Inflammation (0.181) | pINCY |
| 155 | Reproductive (0.286) Urologic (0.286) Cardiovascular (0.143) | Cell Proliferation (0.857) Inflammation (0.429) | pINCY |
| 156 | Reproductive (0.299) Gastrointestinal (0.216) Cardiovascular (0.120) | Cell Proliferation (0.767) Inflammation (0.246) | pINCY |
| 157 | Nervous (0.222) Reproductive (0.222) | Cell Proliferation (0.333) Inflammation (0.222) | pINCY |
| 158 | Reproductive (0.429) Nervous (0.357) | Cell Proliferation (0.286) Inflammation (0.357) | pINCY |

Table 4

| Nucleotide SEQ ID NO: | Clone ID | Library | Library Comment |
|--------------------------|----------|-----------|---|
| 80 | 153831 | THP1PLB02 | The THP1PLB02 library was constructed by reamplification of THP1PLB01, which was made using RNA isolated from THP-1 cells cultured for 48 hours with 100 ng/ml phorbol ester (PMA), followed by a 4-hour culture in media containing 1 g/ml LPS. THP-1 (ATCC TIB 202) is a human promonocyte line derived from the peripheral blood of a 1-year-old male with acute monocytic leukemia (ref: Int. J. Cancer (1980) 26:171). |
| 81 | 350629 | LVENNOT01 | The LVENNOT01 library was constructed using RNA isolated from the left ventricle of a 51-year-old Caucasian female, who died from an intracranial bleed. |
| 82 | 729171 | LUNGNOT03 | The LUNGNOT03 library was constructed using polyA RNA isolated from nontumorous lung tissue of a 79-year-old Caucasian male. Tissue had been removed from the upper and lower left lobes of the lung, superior (left paratracheal) and inferior (subclavian) mediastinal lymph nodes, and the right paratracheal region. Pathology for the associated tumor tissue indicated grade 4 carcinoma. Patient history included a benign prostate neoplasm, atherosclerosis, benign hypertension, and tobacco use. |
| 83 | 1273641 | TESTTUT02 | The TESTTUT02 library was constructed using polyA RNA isolated from a testicular tumor removed from a 31-year-old Caucasian male during unilateral orchiectomy. Pathology indicated embryonal carcinoma forming a largely necrotic mass involving the entire testicle. Rare foci of residual testicle showed intralobular germ cell neoplasia and tumor was identified at the spermatic cord margin. |
| 84 | 1427389 | SINTBST01 | The SINTBST01 library was constructed using polyA RNA isolated from the ileum tissue of an 18-year-old Caucasian female with irritable bowel syndrome (IBS). Pathology indicated Crohn's disease of the ileum, involving 15 cm of the small bowel. Patient history included osteoporosis of the vertebra and abnormal blood chemistry. Family history included cerebrovascular disease and atherosclerotic coronary artery disease. |
| 85 | 1458357 | COLNFET02 | The COLNFET02 library was constructed using RNA isolated from the colon tissue of a Caucasian female fetus, who died at 20 weeks' gestation from fetal demise. Serology was negative. |
| 86 | 1482837 | CORPNOT02 | The CORPNOT02 library was constructed using polyA RNA isolated from diseased corpus callosum tissue removed from the brain of a 74-year-old Caucasian male, who died from Alzheimer's disease. Serologies were negative. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|--|
| 87 | 1517434 | PANCTUT01 | The PANCTUT01 library was constructed using polyA RNA isolated from pancreatic tumor tissue removed from a 65-year-old Caucasian female during radical subtotal pancreatectomy. Pathology indicated an invasive grade 2 adenocarcinoma. Patient history included osteoarthritis, benign hypertension, atherosclerotic coronary artery disease, an acute myocardial infarction, benign neoplasm in the large bowel, and a cataract disorder. Family history included benign hypertension and atherosclerotic coronary artery disease, Type II diabetes, impaired renal function, and stomach cancer. |
| 88 | 1536052 | SPLNNOT04 | The SPLNNOT04 library was constructed using polyA RNA isolated from the spleen tissue of a 2-year-old Hispanic male, who died from cerebral anoxia. Past medical history and serologies were negative. |
| 89 | 1666118 | BRSTNOT09 | The BRSTNOT09 library was constructed using polyA RNA isolated from nontumor breast tissue removed from a 45-year-old Caucasian female during unilateral extended simple mastectomy. Pathology for the associated tumor tissue indicated invasive nuclear grade 2-3 adenocarcinoma in the same breast, with 3 of 23 lymph nodes positive for metastatic disease. There were also positive estrogen/progesterone receptors and uninvolved tissue showing proliferative changes. Patient history included valvuloplasty of mitral valve without replacement, rheumatic mitral insufficiency, rheumatic heart disease, and tobacco use. Family history included acute myocardial infarction, atherosclerotic coronary artery disease, and Type II diabetes. |
| 90 | 1675560 | BLADNOT05 | The BLADNOT05 library was constructed using polyA RNA isolated from nontumorous bladder tissue removed from a 60-year-old Caucasian male during a radical cystectomy, prostatectomy, and vasectomy. Pathology for the associated tumor tissue indicated grade 3 transitional cell carcinoma. The patient presented with dysuria. Family history included Type I diabetes, a malignant neoplasm of the stomach, atherosclerotic coronary artery disease, and an acute myocardial infarction. |
| 91 | 1687323 | PROSTUT10 | The PROSTUT10 library was constructed using polyA RNA isolated from prostatic tumor tissue removed from a 66-year-old Caucasian male during radical prostatectomy and regional lymph node excision. Pathology indicated an adenocarcinoma (Gleason grade 2+3). Adenofibromatous hyperplasia was also present. The patient presented with elevated prostate specific antigen (PSA). Family history included prostate cancer, secondary bone cancer, and benign hypertension. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|--|
| 92 | 1692236 | PROSTUT10 | The PROSTUT10 library was constructed using polyA RNA isolated from prostatic tumor tissue removed from a 66-year-old Caucasian male during radical prostatectomy and regional lymph node excision. Pathology indicated an adenocarcinoma (Gleason grade 2+3). Adenofibromatous hyperplasia was also present. The patient presented with elevated prostate specific antigen (PSA). Family history included prostate cancer, secondary bone cancer, and benign hypertension. |
| 93 | 1720847 | BLADNOT06 | The BLADNOT06 library was constructed using polyA RNA isolated from the posterior wall bladder tissue removed from a 66-year-old Caucasian male during a radical prostatectomy, radical cystectomy, and urinary diversion. Pathology for the associated tumor tissue indicated grade 3 transitional cell carcinoma. The patient presented with prostatic inflammatory disease. Family history included a malignant breast neoplasm, benign hypertension, cerebrovascular disease, atherosclerotic coronary artery disease, and lung cancer. |
| 94 | 1752821 | LIVRTUT01 | The LIVRTUT01 library was constructed using polyA RNA isolated from liver tumor tissue removed from a 51-year-old Caucasian female during a hepatic lobectomy. Pathology indicated metastatic grade 3 adenocarcinoma consistent with colon cancer. Patient history included thrombophlebitis and pure hypercholesterolemia. Patient medications included Premarin and Provera. The patient had also received 8 cycles of fluorouracil and leucovorin in the two years prior to surgery. Family history included a malignant neoplasm of the liver. |
| 95 | 1810923 | PROSTUT12 | The PROSTUT12 library was constructed using polyA RNA isolated from prostate tumor tissue removed from a 65-year-old Caucasian male during a radical prostatectomy. Pathology indicated an adenocarcinoma (Gleason grade 2+2). Adenofibromatous hyperplasia was also present. The patient presented with elevated prostate specific antigen (PSA). |
| 96 | 1822315 | GBLATUT01 | The GBLATUT01 library was constructed using polyA RNA isolated from gallbladder tumor tissue removed from a 78-year-old Caucasian female during a cholecystectomy. Pathology indicated invasive grade 3 transitional cell carcinoma. The patient was taking Indural (propranolol hydrochloride) for hypertension. Family history included a cholecystectomy, atherosclerosis, hyperlipidemia, and benign hypertension. |
| 97 | 1877777 | LEUKNOT03 | The LEUKNOT03 library was constructed using polyA RNA isolated from white blood cells of a 27-year-old female with blood type A+. The donor tested negative for cytomegalovirus (CMV). |
| 98 | 1879819 | LEUKNOT03 | The LEUKNOT03 library was constructed using polyA RNA isolated from white blood cells of a 27-year-old female with blood type A+. The donor tested negative for cytomegalovirus (CMV). |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|---|
| 99 | 1932945 | COLNNOT16 | The COLNNOT16 library was constructed using polyA RNA isolated from nontumorous sigmoid colon tissue removed from a 62-year-old Caucasian male during a sigmoidectomy and permanent colostomy. Pathology for the associated tumor tissue indicated invasive grade 2 adenocarcinoma. Family history included benign hypertension, atherosclerotic coronary artery disease, hyperlipidemia, breast cancer, and prostate cancer. |
| 100 | 2061026 | OVARNOT03 | The OVARNOT03 library was constructed using polyA RNA isolated from nontumorous ovarian tissue removed from a 43-year-old Caucasian female during a bilateral salpingo-oophorectomy. Pathology for the associated tumor tissue indicated grade 2 mucinous cystadenocarcinoma. Family history included atherosclerotic coronary artery disease, pancreatic cancer, stress reaction, cerebrovascular disease, breast cancer, and uterine cancer. |
| 101 | 2096687 | BRAITUT02 | The BRAITUT02 library was constructed using polyA RNA isolated from brain tumor tissue removed from the frontal lobe of a 58-year-old Caucasian male during excision of a cerebral meningeal lesion. Pathology indicated a grade 2 metastatic hypernephroma. Patient history included a grade 2 renal cell carcinoma, insomnia, and chronic airway obstruction. Previous surgeries included a nephroureterectomy. Patient medications included Decadron (dexamethasone) and Dilantin (phenytoin). Family history included a malignant neoplasm of the kidney. |
| 102 | 2100530 | BRAITUT02 | The BRAITUT02 library was constructed using polyA RNA isolated from brain tumor tissue removed from the frontal lobe of a 58-year-old Caucasian male during excision of a cerebral meningeal lesion. Pathology indicated a grade 2 metastatic hypernephroma. Patient history included a grade 2 renal cell carcinoma, insomnia, and chronic airway obstruction. Previous surgeries included a nephroureterectomy. Patient medications included Decadron (dexamethasone) and Dilantin (phenytoin). Family history included a malignant neoplasm of the kidney. |
| 103 | 2357636 | LUNGNOT20 | The LUNGNOT20 library was constructed using polyA RNA isolated from lung tissue removed from the right upper lobe of a 61-year-old Caucasian male during a segmental lung resection. Pathology indicated panacinar emphysema. Family history included a subdural hemorrhage, cancer at an unidentified site, benign hypertension, atherosclerotic coronary artery disease, pneumonia, and an unspecified muscle disorder. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|---|
| 104 | 2365230 | ADREN0107 | The ADREN0107 library was constructed using polyA RNA isolated from adrenal tissue removed from a 61-year-old female during a bilateral adrenalectomy. Patient history included an unspecified disorder of the adrenal glands, depressive disorder, benign hypertension, vocal cord paralysis, hemiplegia, subarachnoid hemorrhage, communicating hydrocephalus, neoplasm of uncertain behavior of pituitary gland, hyperlipidemia, Type II diabetes, a benign neoplasm of the colon, osteoarthritis, Meckel's diverticulum, and tobacco use. Previous surgeries included total excision of the pituitary gland and a unilateral thyroid lobectomy. Patient medications included Calderol and Premarin (conjugated estrogen). Family history included prostate cancer, benign hypertension, myocardial infarction, atherosclerotic coronary artery disease, congestive heart failure, hyperlipidemia, depression, anxiety disorder, colon cancer, and gas gangrene. |
| 105 | 2455121 | ENDANOT01 | The ENDANOT01 library was constructed using polyA RNA isolated from aortic endothelial cell tissue from an explanted heart removed from a male during a heart transplant. |
| 106 | 2472514 | THPINOT03 | The THPINOT03 library was constructed using polyA RNA isolated from untreated THP-1 cells. THP-1 (ATCC TIB 202) is a human promonocyte line derived from the peripheral blood of a 1-year-old Caucasian male with acute monocytic leukemia (ref: Int. J. Cancer (1980) 26:171). |
| 107 | 2543486 | UTRSNOT11 | The UTRSNOT11 library was constructed using polyA RNA isolated from uterine myometrial tissue removed from a 43-year-old female during a vaginal hysterectomy and salpingo-oophorectomy. The endometrium was in proliferative phase. Family history included benign hypertension, hyperlipidemia, colon cancer, Type II diabetes, and atherosclerotic coronary artery disease. |
| 108 | 2778171 | OVARTUT03 | The OVARTUT03 library was constructed using polyA RNA isolated from ovarian tumor tissue removed from the left ovary of a 52-year-old mixed ethnicity female during a total abdominal hysterectomy, bilateral salpingo-oophorectomy, peritoneal and lymphatic structure biopsy, regional lymph node excision, and peritoneal tissue destruction. Pathology indicated an invasive grade 3 (of 4) seroanaplastic carcinoma. Pathology also indicated a metastatic grade 3 seroanaplastic carcinoma. Patient history included breast cancer, chronic peptic ulcer, joint pain, and a normal delivery. Family history included colon cancer, cerebrovascular disease, breast cancer, Type II diabetes, esophagus cancer, and depressive disorder. |
| 109 | 2799575 | PENCNOT01 | The PENCNOT01 library was constructed using polyA RNA isolated from penis corpus cavernosum tissue removed from a 53-year-old male. Patient history included an untreated penile carcinoma. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|---|
| 110 | 2804955 | BLADTUT08 | The BLADTUT08 library was constructed using polyA RNA isolated from bladder tumor tissue removed from a 72-year-old Caucasian male during a radical cystectomy and prostatectomy. Pathology indicated an invasive grade 3 (of 3) transitional cell carcinoma. Family history included myocardial infarction, cerebrovascular disease, and brain cancer. |
| 111 | 2806395 | BLADTUT08 | The BLADTUT08 library was constructed using polyA RNA isolated from bladder tumor tissue removed from a 72-year-old Caucasian male during a radical cystectomy and prostatectomy. Pathology indicated an invasive grade 3 (of 3) transitional cell carcinoma. Family history included myocardial infarction, cerebrovascular disease, and brain cancer. |
| 112 | 2836858 | TYMNOT03 | The TYMNOT03 library was constructed using polyA RNA isolated from nonactivated Th1 cells. These cells were differentiated from umbilical cord CD4 T cells with IL-12 and B7-transfected COS cells. |
| 113 | 2844513 | DRGLNOT01 | The DRGLNOT01 library was constructed using polyA RNA isolated from dorsal root ganglion tissue removed from the low thoracic/high lumbar region of a 32-year-old Caucasian male, who died from acute pulmonary edema, acute bronchopneumonia, bilateral pleural effusions, pericardial effusion, and malignant lymphoma (natural killer cell type). Patient medications included Diflucan (fluconazole), Deltasone (prednisone), hydrocodone, Lortab, Alprazolam, Reazodone, Cytobom, Etoposide, Cisplatin, Cytarabine, and dexamethasone. The patient received radiation therapy and multiple blood transfusions. |
| 114 | 3000380 | TYMNOT06 | The TYMNOT06 library was constructed using polyA RNA isolated from activated Th2 cells. These cells were differentiated from umbilical cord CD4 T cells with IL-4 in the presence of anti-IL-12 antibodies and B7-transfected COS cells, and then activated for six hours with anti-CD3 and anti-CD28 antibodies. |
| 115 | 182532 | PLACNOB01 | The PLACNOB01 library was constructed using RNA isolated from placenta. |
| 116 | 239589 | HIPONOT01 | The HIPONOT01 library was constructed using RNA isolated from the hippocampus tissue of a 72-year-old Caucasian female who died from an intracranial bleed. Patient history included nose cancer, hypertension, and arthritis. |
| 117 | 1671302 | BMARNOT03 | The BMARNOT03 library was constructed using RNA isolated from the left tibial bone marrow tissue of a 16-year-old Caucasian male during a partial left tibial osteotomy with free skin graft. Patient history included an abnormality of the red blood cells. Family history included osteoarthritis. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|--|
| 118 | 2041858 | HIPONON02 | This normalized hippocampus library was constructed from 1.13M independent clones from HIPONOT01 library. RNA was isolated from the hippocampus tissue of a 72-year-old Caucasian female who died from an intracranial bleed. Patient history included nose cancer, hypertension, and arthritis. The normalization and hybridization conditions were adapted from Soares et al. (PNAS (1994) 91:9928). |
| 119 | 2198863 | SPLNFET02 | The SPLNFET02 library was constructed using RNA isolated from spleen tissue removed from a Caucasian male fetus, who died at 23 weeks gestation. |
| 120 | 3250703 | SEMVNOT03 | The SEMVNOT03 library was constructed using RNA isolated from seminal vesicle tissue removed from a 56-year-old male during a radical prostatectomy. Pathology for the associated tumor tissue indicated adenocarcinoma (Gleason grade 3+3). |
| 121 | 350287 | LVENNOT01 | The LVENNOT01 library was constructed using RNA isolated from the left ventricle of a 51-year-old Caucasian female who died from intracranial bleeding. |
| 122 | 1618171 | BRAITUT12 | The BRAITUT12 library was constructed using RNA isolated from brain tumor tissue removed from the left frontal lobe of a 40-year-old Caucasian female during excision of a cerebral meningial lesion. Pathology indicated grade 4 gemistocytic astrocytoma. Medications included dexamethasone and phenytoin sodium. |
| 123 | 1625863 | COLNPOT01 | The COLNPOT01 library was constructed using RNA isolated from colon polyp tissue removed from a 40-year-old Caucasian female during a total colectomy. Pathology indicated an inflammatory pseudopolyp; this tissue was associated with a focally invasive grade 2 adenocarcinoma and multiple tubovillous adenomas. Patient history included a benign neoplasm of the bowel. Medications included Zantac, betamethasone, furosemide, and amiodarone. |
| 124 | 1638353 | UTRSNOT06 | The UTRSNOT06 library was constructed using RNA isolated from myometrial tissue removed from a 50-year-old Caucasian female during a vaginal hysterectomy. Pathology indicated residual atypical complex endometrial hyperplasia. Pathology for the associated tissue removed during dilation and curettage indicated fragments of atypical complex hyperplasia and a single microscopic focus suspicious for grade 1 adenocarcinoma. Patient history included benign breast neoplasm, hypothyroid disease, polypectomy, and arthralgia. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|---|
| 125 | 1726843 | PROSNOT14 | The PROSNOT14 library was constructed using RNA isolated from diseased prostate tissue removed from a 60-year-old Caucasian male during radical prostatectomy and regional lymph node excision. Pathology indicated adenofibromatous hyperplasia. Pathology for the associated tumor tissue indicated an adenocarcinoma (Gleason grade 3+4). The patient presented with elevated prostate specific antigen (PSA). Patient history included a kidney cyst and hematuria. Family history included benign hypertension, cerebrovascular disease, and arteriosclerotic coronary artery disease. |
| 126 | 1754506 | LIVRTUT01 | The LIVRTUT01 library was constructed using RNA isolated from liver tumor tissue removed from a 51-year-old Caucasian female during a hepatic lobectomy. Pathology indicated metastatic grade 3 adenocarcinoma consistent with colon cancer. Medications included Premarin, Provera, and earlier, fluorouracil, and leucovorin. Family history included a malignant neoplasm of the liver. |
| 127 | 1831378 | THPIAZT01 | The THPIAZT01 library was constructed using RNA isolated from THP-1 promonocyte cells treated for 3 days with 0.8 micromolar 5-aza-2'-deoxycytidine. THP-1 (ATCC TIB 202) is a human promonocyte line derived from peripheral blood of a one-year-old Caucasian male with acute monocytic leukemia (Int. J. Cancer (1980) 26:171). |
| 128 | 1864943 | PROSNOT19 | The PROSNOT19 library was constructed using RNA isolated from diseased prostate tissue removed from a 59-year-old Caucasian male during a radical prostatectomy with regional lymph node excision. Pathology indicated adenofibromatous hyperplasia. Pathology for the associated tumor tissue indicated an adenocarcinoma (Gleason grade 3+3). The patient presented with elevated prostate-specific antigen (PSA). Family history included benign hypertension, multiple myeloma, hyperlipidemia, and rheumatoid arthritis. |
| 129 | 1911316 | CONNTUT01 | The CONNTUT01 library was constructed using RNA isolated from a soft tissue tumor removed from the clival area of the skull of a 30-year-old Caucasian female. Pathology indicated chondroid chordoma with neoplastic cells reactive for keratin. Medications included medroxyprogesterone acetate. |
| 130 | 1943120 | HIPONOT01 | The HIPONOT01 library was constructed using RNA isolated from the hippocampus tissue of a 72-year-old Caucasian female who died from intracranial bleeding. Patient history included nose cancer, hypertension, and arthritis. |
| 131 | 2314236 | NGANNOT01 | The NGANNOT01 library was constructed using RNA isolated from tumorous neuroganglion tissue removed from a 9-year-old Caucasian male during a soft tissue excision of the chest wall. Pathology indicated a ganglioneuroma forming an encapsulated lobulated mass. The tissue from the medial aspect pleura surrounding the tumor showed fibrotic tissue with chronic inflammation. Family history included asthma. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|------------|--|
| 132 | 2479409 | SMC'ANO101 | The SMC'ANO101 library was constructed using RNA isolated from an aortic smooth muscle cell line derived from the explanted heart of a male during a heart transplant. |
| 133 | 2683149 | SINIUCT01 | The SINIUCT01 library was constructed using RNA isolated from ileum tissue obtained from a 42-year-old Caucasian male during a total intra-abdominal colectomy and endoscopic jejunostomy. Previous surgeries included polypectomy, colonoscopy, and spinal canal exploration. Medications included Prednisone, mesalamine, and Deltasone. Family history included cerebrovascular disease, benign hypertension, atherosclerotic coronary artery disease, and type II diabetes. |
| 134 | 2774051 | PANCNOT15 | The PANCNOT15 library was constructed using RNA isolated from diseased pancreatic tissue removed from a 15-year-old Caucasian male during an exploratory laparotomy with distal pancreatectomy and total splenectomy. Pathology indicated islet cell hyperplasia. A single pancreatic lymph node was negative. Family history included prostate cancer and cardiovascular disease. |
| 135 | 2869038 | THYRNOT10 | The THYRNOT10 library was constructed using RNA isolated from the diseased left thyroid tissue removed from a 30-year-old Caucasian female during a unilateral thyroid lobectomy and parathyroid reimplantation. Pathology indicated lymphocytic thyroiditis. Pathology for the associated tumor indicated grade 1 (of 4) papillary carcinoma of the right thyroid gland, follicular variant. Multiple perithyroidal and other lymph nodes were negative. Patient history included hyperlipidemia and benign ovary neoplasm. Medications included Premarian, Provera, and Anaprox. |
| 136 | 2918334 | THYMFET03 | The THYMFET03 library was constructed using RNA isolated from thymus tissue removed from a Caucasian male fetus who died at premature birth. Serology was negative. |
| 137 | 2949916 | KIDNFET01 | The KIDNFET01 library was constructed using RNA isolated from kidney tissue removed from a Caucasian female fetus, who died at 17 weeks gestation from anencephalus. Serology was negative. |
| 138 | 2989375 | KIDNFET02 | The KIDNFET02 library was constructed using RNA isolated from kidney tissue removed from a Caucasian male fetus who was stillborn with a hypoplastic left heart at 23 weeks gestation. Serology was negative. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|---|
| 139 | 3316764 | PROSBP103 | The PROSBP103 library was constructed using RNA isolated from diseased prostate tissue removed from a 59-year-old Caucasian male during a radical prostatectomy and regional lymph node excision. Pathology indicated benign prostatic hyperplasia. Pathology for the associated tumor indicated adenocarcinoma, Gleason grade 3+3. The patient presented with elevated prostate specific antigen (PSA), benign hypertension, and hyperlipidemia. Medications included Lotensin and Pravachol. Family history included cerebrovascular disease, benign hypertension, and prostate cancer. |
| 140 | 3359559 | PROSTUT16 | The PROSTUT16 library was constructed using RNA isolated from prostate tumor tissue removed from a 55-year-old Caucasian male. Pathology indicated adenocarcinoma, Gleason grade 5+4. Adenofibromatous hyperplasia was also present. The patient presented with elevated prostate specific antigen (PSA). Patient history included calculus of the kidney. Family history included lung cancer and breast cancer. |
| 141 | 4289208 | BRABDIR01 | The BRABDIR01 library was constructed using RNA isolated from diseased cerebellum tissue removed from the brain of a 57-year-old Caucasian male who died from a cerebrovascular accident. Patient history included Huntington's disease, emphysema, and long-term tobacco use. |
| 142 | 2454013 | ENDANOT01 | The ENDANOT01 library was constructed using RNA isolated from aortic endothelial cell tissue from an explanted heart removed from a male during a heart transplant. |
| 143 | 2454048 | ENDANOT01 | The ENDANOT01 library was constructed using RNA isolated from aortic endothelial cell tissue from an explanted heart removed from a male during a heart transplant. |
| 144 | 2479282 | SMCANOT01 | The SMCANOT01 library was constructed using RNA isolated from an aortic smooth muscle cell line derived from the explanted heart of a male during a heart transplant. |
| 145 | 2483432 | SMCANOT01 | The SMCANOT01 library was constructed using RNA isolated from an aortic smooth muscle cell line derived from the explanted heart of a male during a heart transplant. |
| 146 | 2493824 | ADRETUT05 | The ADRETUT05 library was constructed using RNA isolated from adrenal tumor tissue removed from a 52-year-old Caucasian female during a unilateral adrenalectomy. Pathology indicated a pheochromocytoma. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|---|
| 147 | 2555823 | THYMNOT03 | The THYMNOT03 library was constructed using 0.5 micrograms of polyA RNA isolated from thymus tissue removed from a 21-year-old Caucasian male during a thymectomy. Pathology indicated an unremarkable thymus and a benign parathyroid adenoma in the right inferior parathyroid. Patient history included atopic dermatitis, a benign neoplasm of the parathyroid, and tobacco use. Patient medications included multivitamins. Family history included atherosclerotic coronary artery disease and benign hypertension. |
| 148 | 2598242 | OVARTUT02 | The OVARTUT02 library was constructed using RNA isolated from ovarian tumor tissue removed from a 51-year-old Caucasian female during an exploratory laparotomy, total abdominal hysterectomy, salpingo-oophorectomy, and an incidental appendectomy. Pathology indicated mucinous cystadenoma presenting as a multifolliculated neoplasm involving the entire left ovary. The right ovary contained a follicular cyst and a hemorrhagic corpus luteum. The uterus showed proliferative endometrium and a single intramural leiomyoma. The peritoneal biopsy indicated benign glandular inclusions consistent with endosalpingiosis. Family history included atherosclerotic coronary artery disease, benign hypertension, breast cancer, and uterine cancer. |
| 149 | 2634120 | COLNTUT15 | The COLNTUT15 library was constructed using RNA isolated from colon tumor tissue obtained from a 64-year-old Caucasian female during a right hemicolectomy with ileostomy and bilateral salpingo-oophorectomy (removal of the fallopian tubes and ovaries). Pathology indicated an invasive grade 3 adenocarcinoma. Patient history included hypothyroidism, depression, and anemia. Family history included colon cancer and uterine cancer. |
| 150 | 2765411 | BRSTNOT12 | The BRSTNOT12 library was constructed using RNA isolated from diseased breast tissue removed from a 32-year-old Caucasian female during a bilateral reduction mammoplasty. Pathology indicated nonproliferative fibrocystic disease. Family history included benign hypertension and atherosclerotic coronary artery disease. |
| 151 | 2769412 | COLANOT02 | The COLANOT02 library was constructed using RNA isolated from diseased ascending colon tissue removed from a 25-year-old Caucasian female during a multiple segmental resection of the large bowel. Pathology indicated moderately to severely active chronic ulcerative colitis, involving the entire colectomy specimen and sparing 2 cm of the attached ileum. Grossly, the specimen showed continuous involvement from the rectum proximally; marked mucosal atrophy and no skip areas were identified. Microscopically, the specimen showed dense, predominantly mucosal inflammation and crypt abscesses. Patient history included benign large bowel neoplasm. |

Table 4 (cont.)

| Protein SEQ ID NO: | Clone ID | Library | Library Comment |
|-----------------------|----------|-----------|--|
| 152 | 2842779 | DRGLNOT01 | The DRGLNOT01 library was constructed using RNA isolated from dorsal root ganglion tissue removed from the low thoracic/high lumbar region of a 32-year-old Caucasian male who died from acute pulmonary edema and bronchopneumonia, bilateral pleural and pericardial effusions, and malignant lymphoma (natural killer cell type). Patient history included probable cytomegalovirus, infection, hepatic congestion and steatosis, splenomegaly, hemorrhagic cystitis, thyroid hemorrhage, and Bell's palsy. |
| 153 | 2966260 | SCORNOT04 | The SCORNOT04 library was constructed using RNA isolated from cervical spinal cord tissue removed from a 32-year-old Caucasian male who died from acute pulmonary edema and bronchopneumonia, bilateral pleural and pericardial effusions, and malignant lymphoma (natural killer cell type). Patient history included probable cytomegalovirus, infection, hepatic congestion and steatosis, splenomegaly, hemorrhagic cystitis, thyroid hemorrhage, and Bell's palsy. |
| 154 | 2993326 | KIDNFET02 | The KIDNFET02 library was constructed using RNA isolated from kidney tissue removed from a Caucasian male fetus, who was stillborn with a hypoplastic left heart and died at 23 weeks' gestation. |
| 155 | 3001124 | TLYMNOT06 | The TLYMNOT06 library was constructed using 0.5 micrograms of polyA RNA isolated from activated Th2 cells. These cells were differentiated from umbilical cord CD4 T cells with IL-4 in the presence of anti-IL-12 antibodies and B7-transfected COS cells, and then activated for six hours with anti-CD3 and anti-CD28 antibodies. |
| 156 | 3120070 | LUNGTUT13 | The LUNGTUT13 library was constructed using RNA isolated from tumorous lung tissue removed from the right upper lobe of a 47-year-old Caucasian male during a segmental lung resection. Pathology indicated invasive grade 3 (of 4) adenocarcinoma. Family history included atherosclerotic coronary artery disease, and type II diabetes. |
| 157 | 3133035 | SMCCNOT01 | The SMCCNOT01 library was constructed using RNA isolated from smooth muscle cells removed from the coronary artery of a 3-year-old Caucasian male. |
| 158 | 3436879 | PENCNOT05 | The PENCNOT05 library was constructed using RNA isolated from penis left corpus cavernosum tissue. |

Table 5

| Program | Description | Reference | Parameter Threshold |
|-------------------|---|---|--|
| ABI FACTURA | A program that removes vector sequences and masks ambiguous bases in nucleic acid sequences. | Perkin-Elmer Applied Biosystems, Foster City, CA. | |
| ABI/PARACEL FDF | A Fast Data Finder useful in comparing and annotating amino acid or nucleic acid sequences. | Perkin-Elmer Applied Biosystems, Foster City, CA; Paracel Inc., Pasadena, CA. | Mismatch <50% |
| ABI AutoAssembler | A program that assembles nucleic acid sequences. | Perkin-Elmer Applied Biosystems, Foster City, CA. | |
| BLAST | A Basic Local Alignment Search Tool useful in sequence similarity search for amino acid and nucleic acid sequences. BLAST includes five functions: blastp, blastn, blastx, tblastn, and tblastx. | Altschul, S.F. et al. (1990) J. Mol. Biol. 215:403-410; Altschul, S.F. et al. (1997) Nucleic Acids Res. 25: 3389-3402. | ESTs: Probability value= 1.0E-8 or less Full Length sequences: Probability value= 1.0E-10 or less |
| FASTA | A Pearson and Lipman algorithm that searches for similarity between a query sequence and a group of sequences of the same type. FASTA comprises as least five functions: fasta, tfasta, fastx, tfastx, and ssearch. | Pearson, W.R. and D.J. Lipman (1988) Proc. Natl. Acad. Sci. 85:2444-2448; Pearson, W.R. (1990) Methods Enzymol. 183: 63-98; and Smith, T.F. and M. S. Waterman (1981) Adv. Appl. Math. 2:482-489. | ESTs: fasta E value=1.06E-6 Assembled ESTs: fasta Identity= 95% or greater and Match length=200 bases or greater; fastx E value=1.0E-8 or less Full Length sequences: fastx score=100 or greater |
| BLIMPS | A BLOCKS IMPROVED Searcher that matches a sequence against those in BLOCKS and PRINTS databases to search for gene families, sequence homology, and structural fingerprint regions. | Henikoff, S and J.G. Henikoff, Nucl. Acid Res., 19:6565-72, 1991. J.G. Henikoff and S. Henikoff (1996) Methods Enzymol. 266:88-105; and Attwood, T.K. et al. (1997) J. Chem. Inf. Comput. Sci. 37: 417-424. | Score=1000 or greater; Ratio of Score/Strength = 0.75 or larger; and Probability value= 1.0E-3 or less |
| PFAM | A Hidden Markov Models-based application useful for protein family search. | Krogh, A. et al. (1994) J. Mol. Biol., 235:1501-1531; Sonnhammer, E.L.L. et al. (1988) Nucleic Acids Res. 26:320-322. | Score=10-50 bits, depending on individual protein families |

Table 5 cont.

| Program | Description | Reference | Parameter Threshold |
|-------------|---|--|--|
| ProfileScan | An algorithm that searches for structural and sequence motifs in protein sequences that match sequence patterns defined in Prosite. | Gribskov, M. et al. (1988) CABIOS 4:61-66; Gribskov, et al. (1989) Methods Enzymol. 183:146-159; Bairoch, A. et al. (1997) Nucleic Acids Res. 25: 217-221. | Score= 4.0 or greater |
| Phred | A base-calling algorithm that examines automated sequencer traces with high sensitivity and probability. | Ewing, B. et al. (1998) Genome Res. 8:175-185; Ewing, B. and P. Green (1998) Genome Res. 8:186-194. | |
| Phrap | A Phils Revised Assembly Program including SWAT and CrossMatch, programs based on efficient implementation of the Smith-Waterman algorithm, useful in searching sequence homology and assembling DNA sequences. | Smith, T.F. and M. S. Waterman (1981) Adv. Appl. Math. 2:482-489; Smith, T.F. and M. S. Waterman (1981) J. Mol. Biol. 147:195-197; and Green, P., University of Washington, Seattle, WA. | Score= 120 or greater; Match length= 56 or greater |
| Consed | A graphical tool for viewing and editing Phrap assemblies | Gordon, D. et al. (1998) Genome Res. 8:195-202. | |
| SPScan | A weight matrix analysis program that scans protein sequences for the presence of secretory signal peptides. | Nielson, H. et al. (1997) Protein Engineering 10:1-6; Claverie, J.M. and S. Audic (1997) CABIOS 12: 431-439. | Score=5 or greater |
| Motifs | A program that searches amino acid sequences for patterns that matched those defined in Prosite. | Bairoch et al. <u>supra</u> ; Wisconsin Package Program Manual, version 9, page M51-59, Genetics Computer Group, Madison, WI. | |